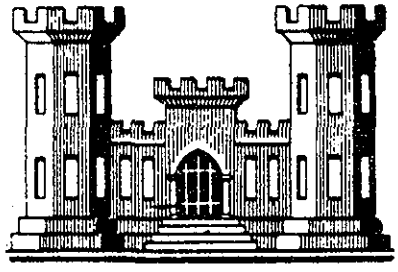
HOUSATONIC RIVER FLOOD CONTROL

ANSONIA - DERBY
LOCAL PROTECTION

NAUGATUCK RIVER, CONNECTICUT

DESIGN MEMORANDUM NO.3

GENERAL DESIGN AND SITE GEOLOGY



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

JANUARY 1966

54

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-E

20 December 1966

SUBJECT: Ansonia-Derby Local Protection Project, Naugatuck River, Connecticut - Supplement No. 1, Design Memorandum No. 3, General Design and Site Geology

TO: Chief of Engineers
ATTN: ENGCW-E

There is submitted herewith for review and approval Supplement No. 1, Design Memorandum No. 3, General Design and Site Geology, for the Ansonia-Derby Local Protection Project, Housatonic River Basin, Connecticut, in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

J. W. Leslie

JOHN Wm. LESLIE
Chief, Engineering Division

1 Incl
as

FLOOD CONTROL PROJECT

ANSONIA-DERBY LOCAL PROTECTION PROJECT

NAUGATUCK RIVER

HOUSATONIC RIVER BASIN

CONNECTICUT

SUPPLEMENT NO. 1

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN and SITE GEOLOGY

1. The Anaconda American Brass Company has requested that a wall be substituted for the northernmost 475 feet of dike on the left bank of the Naugatuck River in the Ansonia-Derby Local Protection Project.

2. The Ansonia plant of the Anaconda American Brass Company is a multi-building manufacturing complex with most of the floor space devoted to production machinery. Active storage of raw and finished products is a critical factor in the plant's operation because of the limited amount of space available at the plant site for storage. The company has erected three storage sheds at the northern end of their property to meet part of the storage requirements but have to use the land adjacent to it for open storage to meet the rest of their needs. To permit adequate circulation for access to the stored stock, and to meet all the storage requirements, every square foot of the land is necessary. The critical need for space was generated by an expansion of the plant in the period 1964-1965. Substitution of a wall for the dike would preserve 41,400 square feet of the area for open storage which would otherwise be lost to the company. Representatives of this office reviewed conditions at the plant and found that the need for storage was as critical as the company claimed and that depriving the company of over 41,000 square feet of storage space would be detrimental to efficient plant operation.

3. At the time of the most recent damage review of Ansonia (July 1965), the Anaconda American Brass Company had 1,277 employees in Ansonia with an annual payroll of $9,100,000. This figure represents approximately 16% of total employment in Ansonia and over 30% of employment in manufacturing.

4. An inquiry made on 9 December 1966 indicated that the Ansonia plant currently has 1,299 employees with an annual payroll of $10,332,000.

5. While the number of employees resident in Ansonia is unknown, it is probable that over 90% of the employees live in the area of which the city is the shopping and commercial center so that the brass company payroll is a sizeable component in the economy of Ansonia.

6. This office proposes to accede to the company's request for the substitution of a wall for the dike at the north end of the property as a measure justified by the demonstrated need for storage. The difference in cost amounts to approximately $200,000.

7. In the light of the facts set forth above, it is requested that this office be advised if a change in cost sharing for the Ansonia-Derby project is required to reflect the additional cost necessary to meet the needs of the brass company or, if in view of the company's importance in the general economy of the Ansonia area, no additional sharing is required.

8. Attached are the following:

a. Plate No. 3-23 which shows a plan of the dike substantially the same as submitted in Design Memorandum No. 3, General Design and Site Geology. Minor changes have been made which reflect refinement of design.

b. Plate No. 3-24 shows the recommended plan of the proposed flood wall.

c. Plate No. 3-25 is an aerial photograph of the upstream end of the project, showing the Ansonia Plant of the Anaconda American Brass Company. The three new storage sheds and the large plant expansion are discernible on the photograph by their white roofs. The open storage area is located immediately upstream of the plant expansion. The photograph also shows that this is the only area adjacent to the plant available for storage because of the intensive development of the plant area.

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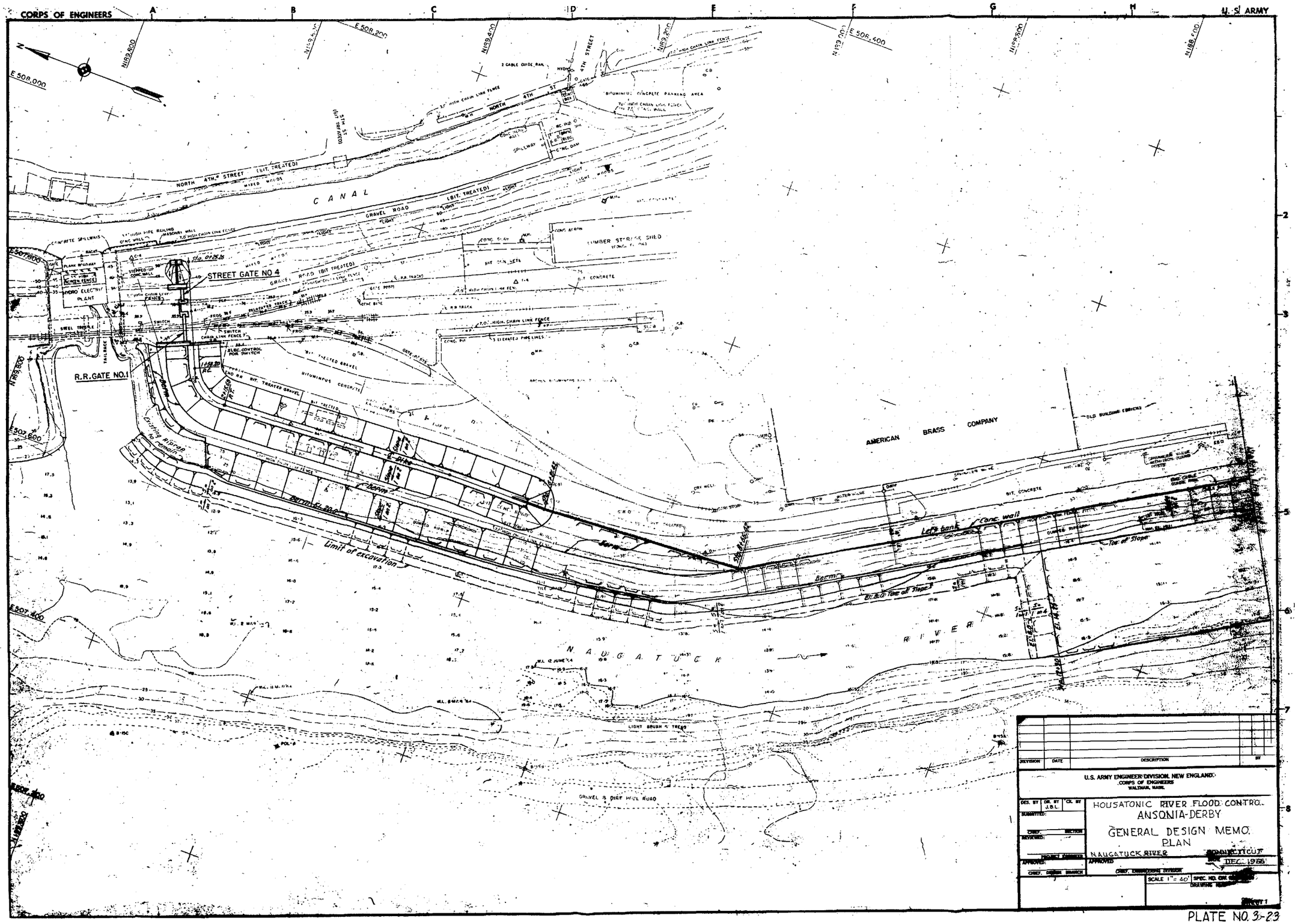
U. S. ARMY



DIVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY J.D.L.	CK. BY
SUBMITTED: CHIEF, SECTION		
REVIEWED: PROJECT ENGINEER		
APPROVED: CHIEF, DESIGN BRANCH		

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA-DERBY
GENERAL DESIGN MEMO.
PLAN
NAUGATUCK RIVER CONNECTICUT

APPROVED DEC. 1966
CHIEF, ENGINEERING DIVISION

SCALE 1" = 40' SPEC. NO. CW-[illegible]
DRAWING NO. [illegible]
SHEET 1

PLATE NO. 3-23

CORPS OF ENGINEERS

U.S. ARMY

N189,800 N189,600 N189,400 N189,200 N189,000 N188,800 N188,600

E 508,000 E 508,200 E 508,400

NORTH 4TH STREET (BIT. TREATED)

CANAL

GRAVEL ROAD (BIT. TREATED)

STREET GATE NO 4

R.R. GATE NO.1

HYDRO ELECTRIC PLANT

CONCRETE SPILLWAYS

LUMBER STORAGE SHED (CONC. FLOOR)

AMERICAN BRASS COMPANY

Berm

Existing Riprap to remain

Left bank Concrete Wall

Excavation line

Toe of Slope

El. 8.0 Toe of Slope

NAUGATUCK RIVER

LIGHT BRUSH & TREES

GRAVEL & DIRT HAUL ROAD

DIVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA-DERBY
RECOMMENDED PLAN
NAUGATUCK RIVER CONNECTICUT
APPROVED DATE DEC. 1966
CHIEF, ENGINEERING DIVISION
SCALE 1"= 40' SPEC. NO. CIV ENG 19-016-
DRAWING NUMBER

PLATE NO 3-24

UPSTREAM END OF PROJECT
ANACONDA AMERICAN BRASS CO.
ANSONIA - DERBY

PLATE NO. 3-25

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASS. 02154

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

NEDED-D

14 January 1966

SUBJECT: Ansonia-Derby Local Protection Project, Naugatuck River, Connecticut - Design Memorandum No. 3 - General Design and Site Geology

TO: Chief of Engineers
ATTN: ENGCW-E

There is submitted herewith, for review and approval, Design Memorandum No. 3, General Design and Site Geology, for the Ansonia-Derby Local Protection Project, Housatonic River Basin, in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

John Wm Leslie

JOHN Wm. LESLIE
Chief, Engineering Division

Incl (10 cys)
Des Memo No. 3

FLOOD CONTROL PROJECT

ANSONIA-DERBY LOCAL PROTECTION PROJECT
NAUGATUCK RIVER
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDA INDEX

No.	Title	Date Submitted	Date Approved
1	Hydrology and Interior Drainage	30 Apr 65	16 Jun 65
2	Omitted		
3	General Design and Site Geology	14 Jan 66	
4	Concrete Materials		
5	Omitted		
6	Embankments, Foundation and Channel Improvements		
7	Detailed Design of Structures		
8	Pumping Stations		
9	Hydraulic Analysis		

FLOOD CONTROL PROJECT

ANSONIA-DERBY LOCAL PROTECTION PROJECT
NAUGATUCK RIVER
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN and SITE GEOLOGY

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FLOOD CONTROL PROJECT

ANSONIA-DERBY LOCAL PROTECTION PROJECT
NAUGATUCK RIVER
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN AND SITE GEOLOGY

JANUARY 1966

A. PERTINENT DATA

1. Purpose — Flood Protection

2. Project Location

State	Connecticut
County	New Haven
Cities	Ansonia and Derby
River	Naugatuck

3. Drainage Areas

Naugatuck River	312. sq. miles
Beaver Brook	3.58 sq. miles

4. Project Design Floods

Naugatuck River	75,000 c.f.s.
Beaver Brook	2,500 c.f.s.

5. Flood Protection Structures

a. Channel Improvement

Length	Bottom Width
1,500'	120'
4,600'	220'
1,300'	10'

b. Levees

Type	Rolled earth fill
Length	10, 400'
Height	Varies 10' to 30'

5. Flood Protection Structures (cont)

c. Flood Walls

Type	Reinforced Concrete
Length, feet	6, 700'
Height	Varies, 10' to 30'

d. Railroad Gates

Type	Swing
Number	5
Area	1,770 S.F.

e. Street Gates

Type	Swing
Number	4
Area	1,360 S.F.

f. Pressure Conduit

Type	Reinforced Concrete
Length	1,300'
Area	8' x 14.5'

g. Pumping Plants

Number	4
Pumps	10
Power	Diesel
Total Capacity	161,250 g.p.m.

6. Principal Quantities

a. Channel Improvement

Excavation, General	330,000 c.y.
Rock, RipRap	19,000 c.y.
Gravel Bedding	11,000 c.y.

b. Levees & Flood Walls

Excavation, General	265,000 c.y.
Excavation, Structural	76,000 c.y.
Impervious Borrow	250,000 c.y.
Impervious Fill, Compacted	160,000 c.y.
Pervious Borrow	100,000 c.y.

6. Principal Quantities (continued)

b. Levees & Flood Walls (cont)

Pervious Fill, Compacted	275,000 c.y.
Random Fill, Compacted	50,000 c.y.
Crushed Stone Fill, Compacted	55,000 c.y.
Backfill, Compacted	75,000 c.y.
Gravel Bedding	39,000 c.y.
Rock Slope Protection	67,000 c.y.
Concrete, Flood Walls	24,775 c.y.
Cement	48,000 bbl.
Steel Reinforcement	3,626,000 lbs.
Sheeting, Left in Place	70,000 s.f.

7. Estimated Costs

Project Feature	Cost
Channels & Canals	$ 715,000.00
Levees & Flood Walls	7,045,000.00
Pumping Plants	825,000.00
Engineering & Design	795,000.00
Supervision & Administration	690,000.00
Estimated Federal First Cost	$10,070,000.00
Lands and Damages	$ 720,000.00
Relocations	185,000.00
Estimated Local Interest First Cost	$ 905,000.00
TOTAL Estimated Project Cost	$10,975,000.00

8. Benefits

Average Annual Benefits	$ 572,000.00
Benefit-Cost Ratio	1.5 to 1

FLOOD CONTROL PROJECT

ANSONIA-DERBY LOCAL PROTECTION PROJECT
NAUGATUCK RIVER
HOUSATONIC RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 3

GENERAL DESIGN AND SITE GEOLOGY

JANUARY 1966

B. INTRODUCTION

1. Purpose

This memorandum furnishes information and presents the general plan for the Ansonia-Derby Local Protection Project. It is intended to facilitate the preparation and review of detailed design memoranda, plans and specifications.

2. Scope

This memorandum presents general data for the Ansonia-Derby Local Protection Project, including costs and benefits. The data contained herein will be supplemented and expanded, as required, by supplement to this memorandum and by subsequent design memoranda.

C. PROJECT AUTHORIZATION

3. Authorization

The Ansonia-Derby Local Flood Protection Project was authorized by the Flood Control Act, approved 23 October 1962, Public Law 87-874, which reads in part as follows:

> "The project for flood protection on the Naugatuck River at Ansonia-Derby, Connecticut, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 437, Eighty-seventh Congress, at an estimated cost of $5,620,000."

4. Chief of Engineers Recommendations

In House Document No. 437, 87th Congress, 2nd Session, the Chief of Engineers recommended the construction of the Ansonia-Derby Local

Protection Project "... provided that, prior to construction, local interests give assurances satisfactory to the Secretary of the Army that they will:

"a. Contribute in cash, because of the more costly plan desired by local interests for the River Street area, 1.4 percent of the construction cost, presently estimated at $80,000, to be paid either in a lump sum prior to start of construction or in installments prior to start of pertinent work items, in accordance with construction schedules as required by the Chief of Engineers, the final contribution to be determined after actual costs are known;

"b. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project including changes to highway bridges and roads, railroad track, sewers, and other utilities;

"c. Hold and save the United States free from damages due to the construction works;

"d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army; and

"e. Prevent encroachment on the improved channels and on the ponding areas, and if capacities are impaired, provide equally effective storage or pumping capacity without cost to the United States."

D. INVESTIGATIONS

5. Interim Report

The interim report on review of survey for flood control, Naugatuck River, Connecticut, dated 13 April 1960, is the report on the Ansonia-Derby Local Protection Project. The report was published without appendices, except letters of comment, in House Document No. 437, 87th Congress, 2nd Session. The preparation of the report was authorized by resolutions of the Committee on Public Works of the United States Senate on 14 September 1955, and the House of Representatives on 13 June 1956 and 23 July 1956. The report provided for the construction of earth dikes, concrete flood walls, stoplog structures, four pumping stations for storm water and sanitary sewage, appurtenant structures and the reconstruction of two bridges.

6. Prior Reports

Flood control of the Naugatuck River and its tributaries has been considered in the following published reports on the Naugatuck River Basin:

a. "308" Report

A report dated 25 June 1931 and printed as House Document No. 246, 72nd Congress, 1st Session, covered navigation, water power, flood control, and irrigation in the Housatonic River Basin. The report found that further improvements were not warranted at that time.

b. 1940 Report

A report dated 20 June 1940 and printed as House Document No. 338, 77th Congress, 1st Session, recommended construction of the Thomaston Dam on the Naugatuck River above Thomaston, Connecticut. This project was authorized by Public Law 534, 78th Congress, 2nd Session, approved 22 December 1944, (placed in operation December 1960).

c. NENYIAC Report

Flood control and allied water uses are considered in Part 2, Chapter XXII, "Housatonic River Basin", of The Resources of the New England - New York Region. This comprehensive report presented an inventory of the resources of the New England - New York area and recommended a master plan to be used as a guide for the regional planning, development, conservation, and use of land, water, and related resources of the region. Proposals to reduce flood losses were also included. Prepared by the New England-New York Inter-Agency Committee, the report was submitted to the President of the United States by the Secretary of the Army on 27 April 1956. Part 1 and Chapter 1 of Part 2 are printed as Senate Document 14, 85th Congress, 1st Session.

d. 1956 Interim Report

An interim report, dated 31 May 1956, and printed as House Document No. 31, 85th Congress, 1st Session, reviewed the need for additional flood control works on the upper Naugatuck River upstream from the authorized Thomaston Reservoir (placed in operation December 1960). The report recommended that the authorized plan for flood control in the Housatonic River be modified to provide for the construction of two flood control dams and reservoirs upstream of Torrington, Connecticut, one on Hall Meadow Brook (placed in operation June 1960) a tributary of the West Branch of the Naugatuck River, and one on the East Branch of the Naugatuck River (placed in operation August 1964). These projects were authorized by the Flood Control Act of 1958 (Public Law 85-500, 85th Congress), approved 3 July 1958.

e. 1958 Interim Report

An Interim Report, dated 30 June 1958 and printed as House Document No. 372, 86th Congress, 2nd Session, reviewed the need for additional flood control works in the Naugatuck River downstream from the authorized Thomaston Reservoir. The report recommended that the authorized plan for flood control in the Housatonic River be modified to provide for the construction of four flood control dams and reservoirs on tributaries of the Naugatuck River downstream from the authorized Thomaston Reservoir. These projects were authorized by the Flood Control Act of 1960 (Public Law 86-645, 86th Congress), approved 14 July 1960.

The Northfield Brook Dam, located on Northfield Brook, is substantially complete.

The Black Rock Dam will be located on Branch Brook. Initial construction funds were provided in Fiscal Year 1966 for land acquisition and the initiation of relocations. Construction of the dam will be initiated in Fiscal Year 1967.

The Hancock Brook Dam, located on Hancock Brook, is substantially complete.

The Hop Brook Dam will be located on Hop Brook. Highway relocations and the dam are currently under construction.

7. Current Investigations

Studies for the project plan utilized the basic data obtained from the previous investigations. In addition, the following new data were obtained and studies made:

a. A new topographic survey was made of the project area. The highly developed areas were surveyed at the scale of one inch equals twenty feet and the less developed areas at one inch equals forty feet. River soundings were taken at appropriate intervals.

b. All available subsurface information has been reviewed and additional geological and soils investigations of foundation conditions and embankment materials are being made.

c. Hydrologic studies have been reviewed and new studies have been made. Design Memorandum No. 1, Hydrology and Interior Drainage, was submitted to the Chief of Engineers on 30 April 1965 and was approved as a basis for future planning on 16 June 1965.

d. Investigations have been made of land taking requirements, rights-of-way, water rights, and utility relocations. New preliminary appraisals of lands and damages have been made.

8. Public Hearings

A public hearing with respect to flood control and allied measures for the Naugatuck River and its tributaries was held in Waterbury, Connecticut, on December 11, 1956. Approximately 175 persons attended, including representatives of Federal, State and municipal governments, industrial and agricultural interests, civic organizations, and interested individuals. Municipal officials and industrial leaders of Ansonia and Derby expressed the need for additional flood protective measures, but did not stipulate specific measures desired.

E. LOCAL COOPERATION

9. Local Cooperation

The project is subject to the specific requirements of local cooperation required by Public Law 87-874, approved 23 October 1962, and House Document No. 437, 87th Congress, 2nd Session. These requirements are quoted in Section C, "Project Authorization", paragraphs 3 and 4, of this memorandum.

Local interests were required to furnish, in addition to lands and relocations, a cash contribution of 1.4 percent of the construction cost, estimated in the Project Document at $80,000, because of the more costly plan they desired for the River Street area. They now desire the most economic plan.

Officials of the City of Ansonia and of the City of Derby have indicated their intentions to proceed with the acquisition of all lands, easements and rights-of-way necessary for the construction of the project. Acquisition would begin upon the approval of this General Design Memorandum. The local interests are aware that a construction start is contingent upon the appropriation of the necessary funds by Congress. They feel that this procedure will provide them with the time necessary to make the acquisitions prior to the scheduled start of construction.

The State of Connecticut, in cooperation with the City of Ansonia, has established encroachment lines on the Naugatuck River in the City of Ansonia. A public hearing was held on this matter on 16 July 1957 and an Order Establishing Encroachment Lines was signed and dated 3 December 1957. These established encroachment lines will be revised to incorporate the improvements made under this flood control project.

The State of Connecticut has enacted legislation necessary to comply with the requirements for local cooperation. Preliminary assurances of local cooperation have been furnished.

F. LOCATION OF PROJECT

10. Location of Project

The Ansonia-Derby Local Protection Project is located in the Cities of Ansonia and Derby, New Haven County, Connecticut, on the Naugatuck River and Beaver Brook tributary. The flood protection project will extend 2 miles along the Naugatuck River, beginning 1,300 feet below the Division Street bridge in the City of Derby, and terminating near the American Brass Company hydroelectric plant in the City of Ansonia. A line of protection will also be constructed on Beaver Brook from 400 feet above Central Street to its confluence with the Naugatuck River.

G. RECOMMENDED PROJECT PLAN

11. Recommended Project Plan

a. Naugatuck River

The proposed plan for containing the main river flow requires about 8,700 linear feet of dikes and 6,450 linear feet of flood walls, about 6,100 linear feet of channel improvement, and the construction of four pumping plants. Miscellaneous utility work will be required including the reconstruction of one sanitary sewer siphon under the river. Several dike alignments were studied and the adopted plan is the most suitable for the location. Detailed features of the project are shown on the plates accompanying this memorandum.

b. Beaver Brook

The proposed plan for containing the tributary flow requires about 1,700 linear feet of dikes and 250 linear feet of flood walls, about 1,300 linear feet of channel improvement, and the construction of approximately 1,300 linear feet of conduit. Miscellaneous utility work will be required including the reconstruction of one sanitary sewer siphon under the brook. Several dike, channel and conduit alignments were studied and the adopted plan is the most suitable for the location.

H. DEPARTURES FROM PROJECT DOCUMENT PLAN

12. Departures from Project Document Plan

There are no major departures from the Project Document Plan alignment. Modifications and refinements have been made during the development of detailed studies based on additional investigations and information obtained, as listed below.

The American Brass Company constructed a 72,000 square foot addition on the north end of their plant. This necessitated the construction of approximately 350 linear feet of flood wall in lieu of dike at the north end of the project.

Two new commercial establishments were constructed on the north side of Maple Street. This necessitated the construction of approximately 430 linear feet of flood wall in lieu of dike to make a tie-in to high ground behind the Ansonia Manufacturing Company.

Local interests were required to furnish, in addition to lands and relocations, a cash contribution of 1.4 percent of the construction costs, estimated in the Project Document at $80,000 because of the more costly plan they desired for the River Street area. This plan consisted of constructing a flood wall against the front wall of the Ansonia Manufacturing Company with stop-log openings for the windows. They now desire the most economic plan and the flood wall was moved to the river side of River Street.

The City of Ansonia constructed, at considerable expense, a municipal parking lot in the area bounded by Bridge Street, West Main Street, and the railroad tracks parallel to the Naugatuck River. The economic survival of the merchants on West Main Street is dependent on this parking lot. To construct a dike as shown in the Project Document Plan would require approximately one-half of the parking area. For this reason, it was necessary to construct approximately 700 linear feet of flood wall in lieu of dike.

The acquisition and demolition of structures for the Downtown Urban Renewal Project made it possible to relocate the Front Street Pumping Station to a site adjacent to the dikes. This will result in a more economical pumping station.

Several studies were made of the Beaver Brook channel between Main Street and the Naugatuck River. Because of the demolition of structures for the renewal project, the use of a pressure conduit in lieu of the flood walls, bridge and stop log structure became the more economical engineering solution.

More detailed hydraulic studies disclosed the need to extend a box conduit approximately 400 feet upstream of Central Street, and to provide a stilling basin immediately downstream of Central Street.

The Division Street Pumping Station was moved approximately 1,100 feet upstream, because engineering studies found this to be a more economical location.

The tie-in to high ground at the downstream end of the project was moved downstream about 300 feet. This was made necessary by the new topographic surveys. It also resulted in the elimination of one street gate.

Both slopes of the dikes in the Interim Report are 1 on 2. Because of seepage and foundation conditions slopes of 1 on 3 on the river side and 1 on 2.5 on the land side are necessary for the dikes required for this project. The top elevations of the dikes are essentially the same as in the Project Document Plan..

To obtain the necessary stability required by criteria, it was necessary to lower the base slabs of the flood walls. Subsurface explorations disclosed man-made fills, which are unsuitable for foundations. The base slabs are estimated at the level of undisturbed foundations.

I. HYDROLOGY

13. Project Design Floods

a. Naugatuck River

The protective works on the Naugatuck River will be designed for the maximum river stage resulting from: (1) the peak discharge in the Naugatuck River of the standard project flood as modified by the authorized comprehensive plan of upstream flood control reservoirs; (2) a concurrent floodflow in the Housatonic River from the same standard project storm; and (3) an abnormal tide in Long Island Sound.

The standard project flood was based on the standard project storm rainfall,as described in Civil Engineer Bulletin No. 52-8, and unit hydrographs derived from analyses of record floods. Without reservoirs, the SPF at Ansonia is 148,000 cfs compared with the record flood in August 1955 with a discharge of 112,000 cfs. With reservoirs, the SPF in the Naugatuck at Ansonia is reduced to 75,000 cfs. The concurrent flow in the Housatonic River is 145,000 cfs.

b. Beaver Brook

Maximum stages in Beaver Brook result from various combinations of discharges in the brook and concurrent stages in the Naugatuck River. The highest stages in the lower 1,500-foot reach are produced by the standard project flood in the Naugatuck River, and the concurrent discharge of 1,000 cfs in Beaver Brook. Maximum flood stages in the upper reach of Beaver Brook are produced by the standard project storm centered over the Beaver Brook watershed. Enlargement of the Beaver Brook channel under a factory building just downstream of Jewett Street bridge, in order to satisfy the standard project flow of 3,180 cfs, was found to be impractical. A design discharge of 2,500 cfs, approximately 80 percent of the standard project flood and twice the flood of record, was selected as the design flood for the upper reach of Beaver Brook.

J. HYDRAULIC ANALYSIS

14. Naugatuck River

a. Computed Water Surface Profile

The project design (standard project flood) water surface for the Naugatuck River was computed by conventional methods as outlined in EM 1110-2-1409, "Backwater Curves in River Channels", assuming a roughness coefficient of .035 and other appropriate losses for changes in channel section and alignment where applicable. A starting elevation, at the downstream end of the protective works near Division Street, of 29 feet msl was determined for a peak flow of 75,000 cfs in the Naugatuck, a concurrent flow of 145,000 cfs in the Housatonic and an abnormal tide in Long Island Sound. The allowance for an abnormal tide amounts to about 2 feet.

b. Computed Average Velocities

Computed average velocities of the design flood from the lower end of the protective works to the New York, New Haven and Hartford Railroad bridge at Station 105+00 are 8-10 fps, except at Division Street bridge where velocities are about 12 fps. Velocities will average 17 fps under the railroad bridge and 10-13 fps from the railroad bridge to Maple Street. From Maple Street bridge to the American Brass Company bridge, computed velocities are 15-17 fps. Above the American Brass Company bridge, velocities decrease from 17 fps at the bridge to 9 fps at the upstream end of the protective works opposite the American Brass Company hydroplant.

15. Beaver Brook

Beaver Brook will flow in a conduit from the downstream side of the factory building near Jewett Street to below Central Street. The conduit will terminate in a stilling basin downstream of Central Street. An open trapezoidal channel will extend from the stilling basin to 150 feet upstream of Main Street. From this point, the brook will flow in a conduit to the Naugatuck River, a distance of about 600 feet.

a. Conduits

The 7.67' x 15' conduit between the factory building and Central Street will flow nearly full with a design discharge of 2,500 cfs at a velocity of 28 fps. This conduit will not be pressurized under normal design conditions. The roof will confine the supercritical flow around the curves.

The 8' x 14.5' conduit at the lower end of Beaver Brook is approximately 600 feet long and will be pressurized under design conditions. The design flow of 2,500 cfs in Beaver Brook concurrent with a low stage in the Naugatuck River will produce a headwater elevation of 29 feet msl. The design flood stage of 32 feet msl in the Naugatuck River and a concurrent flow of 1,000 cfs in Beaver Brook will result in a headwater elevation of 35 feet msl.

b. Open Channel

The trapezoidal channel from the stilling basin below Central Street to the downstream conduit will have a 10-foot bottom width and 1 on 3 side slopes. Velocities during the design flood will be reduced from approximately 32 to 8 fps in the stilling basin. In the open channel downstream of the stilling basin, the average velocity will be about 12 fps. Design flow profiles on both the Naugatuck River and Beaver Brook are shown on plate 3-16.

c. Model Study

A model study of the proposed protection measures and improvements along the Naugatuck River is necessary to assure adequate and economic design. Due to the complex flow conditions, resulting from the combination of abrupt changes in channel section, skewed bridges and bend, hydraulic losses cannot be reliably computed. Final adjustments in grades of the dikes and flood walls will be made after completion of the model study.

K. SITE GEOLOGY

16. Physiography

Ansonia is situated in the Naugatuck River Valley, two miles above the river's confluence with the Housatonic River, and lies at the inshore limit of oceanic tidal influence. The city occupies the valley bottom at this point and partly ascends the adjacent hills which attain heights of 400 to 500 feet. The Naugatuck River at Seymour, four miles north, has a narrow valley which was cut into the western highland since the regional uplift in Tertiary time. Southward, the valley widens until, at Ansonia, sufficient breadth is attained to have permitted the formation of temporary glacial lakes and extensive gravel deposits. Within this lake bed, extending southward from over a mile north of the business center to the Housatonic River, is a deposit of river alluvium, largely gravel, which is about one-half mile in breadth, bordering and underlying the river. The hills surrounding these glacial lakes and recent alluvial deposits are capped with ground moraine consisting of sandy till.

Surficial geology and boring data indicate that bedrock will not be encountered in the required excavations. The only bedrock disclosed by reconnaissance occurs in the spillway of the hydroelectric plant upstream from Maple Street. Ground water will be encountered in excavations adjacent to the river at or near river level and may be subject to minor tidal fluctuation, particularly at the downstream end of the project. Materials to be excavated are indicated to be gravels and sands, the latter fine and silty in part. The distribution of sediments at the site, in the valley bottom, are shown on Plate 3-18, Geologic Sections.

17. Site Investigations

Foundation explorations for the specific structures under study in the survey report were limited to the excavation of 5 test pits and 1 test trench in the dike foundation area on the west bank to determine the character of the foundation fill and natural soils where the dike must be constructed for the greatest hydraulic heads. Foundation conditions were also estimated from logs of borings by others for bridge footings in the immediate area. Subsequent explorations have consisted of 91 borings and seven test trenches. Final locations have not been fixed for all of the auxiliary structures, hence a few additional borings will be made to fix foundation grades and for bidding information, and to provide detailed information for a newly designed conduit at Beaver Brook. Additional explorations also will be made to define an impervious borrow area and for bidding information in the channel excavation area. The location

of borings are shown on Plate 3-17, General Plan of Explorations. Logs of the explorations appear on Plates 3-19 through 3-22, Record of Explorations.

18. Foundation and Excavation Conditions

None of the structures will be founded on bedrock. Overburden is more than 30 feet thick throughout the areas of proposed construction along the banks of the Naugatuck. It consists of sands and gravels of glacial and alluvial origin, much of which overlie glacial lake deposits of fine sand and silt. Most of these natural materials are overlain by fills, generally granular materials, and they attain thicknesses as great as 25 feet (see Geologic Sections, Plate 3-18). The fills are moderately compact and despite containing coal clinkers, ashes and minor amounts of trash, they make suitable foundations for dikes and walls, except for a dump on the west bank from which much of the fill will be removed. Most of the stop log and pumping station and flood wall structures are designed for granular foundation conditions. Ground water will be encountered in excavations at or slightly above river level. The soils to be excavated for the construction of the dike and concrete structures, and for channel improvements are expected to consist largely of sandy gravel and gravelly sand except for the dump area. It remains to be determined whether sufficient material will be obtained from the required excavations to construct the pervious and random portions of all of the dikes, but a bulk of the material will come from these sources. Current construction activities on the west bank connected with a new sewage treatment plant make the determination of such quantities uncertain at this time. Granular materials similar to those from the required excavations can be obtained, if necessary, from nearby sources in the river valley.

19. Availability of Construction Materials

a. Rock

Approximately 125,000 tons of rock will be required for slope protection. The largest commercial source in the area is traprock in Branford about 20 miles distant. Other small traprock quarries in the New Haven area have operated at slightly closer range, but most are inactive. Local quarrying is a distinct possibility, inasmuch as size requirements are less than 1/2 ton, and existing riprap along the river bank was obtained from a small quarry less than three miles northeast of the site. An abandoned face of quartzitic gneiss in this area appears as though it might yield a substantial part of the requirement, but the rock is of variable composition and somewhat altered and fractured.

b. Gravel

About 200,000 c.y. of gravel are required for dikes and channels. Some processed gravel is available commercially within a mile of the work. The bank-run is quite sandy. Natural gravels could be obtained just upstream from the project limit in the river bed, but they are too sandy to meet design requirement for bedding material. Large undeveloped and commercial sources lie about eight miles upstream in the Beacon Falls area. Very bony bank-run material can be obtained there in sufficient quantity.

c. Pervious and Random (sand and gravel)

Current construction activities on the west bank connected with a new sewage treatment plant make it uncertain whether sufficient material will be obtained from required excavations to construct all random and pervious portions of the dikes and similar materials can be obtained, if necessary, from nearby sources in the river valley.

d. Impervious Fill

About 200,000 c.y. of impervious material will be required in the dikes. It is expected that this material will come from glacial till within a seven-mile haul distance. The impervious area will be provided for the use of the contractor. Borings are in progress in Sheldon, about five miles west of the site.

L. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

20. General

The project plan, as shown on Plate No. 3-1 and in more detail on Plates Nos. 3-2 through 3-14, consists of a line of protection on the Naugatuck River approximately two miles long. It extends from the American Brass Company hydroelectric plant in Ansonia into the north and terminates approximately 1,300 feet below the Division Street bridge in the City of Derby. A line of protection will also be constructed on Beaver Brook in Ansonia, extending from about 400 feet above Central Street to its confluence with the Naugatuck River, for a total distance of approximately 2,900 feet.

21. Channel Improvements

Channel improvements consist of excavating the channel of the Naugatuck River for a distance of 1,500 linear feet with a bottom width of approximately 120 feet between the American Brass Company

Bridge and the Maple Street Bridge. This portion of the channel bottom will have stone riprap protection with suitable bedding.

Another portion of channel improvement will be located between the railroad bridge and the mouth of Beaver Brook. This reach will be approximately 4,600 feet long and have an average width of 220 feet.

Channel improvement on Beaver Brook will be about 1,300 feet long with a bottom width of ten feet.

Suitable material from the excavations will be used in dike construction. The remainder will be placed in spoil areas along the excavation limits.

22. Dikes

Dikes will be rolled earth filled, with stone slope protection on the riverside and seeded topsoil on the tops and landside slopes. The thickness of the stone slope protection will vary as required for the various velocities in the channels. The heights of the dikes will vary from approximately 10 to 30 feet. Where possible, dikes will be built on the overbank, with the riverside slope more or less coincident with the existing bank. The greater portion, however, will be located along new river channel. Typical sections are shown on Plates Nos. 3-2 through 3-14.

Detailed design of dikes, cut-offs, underdrains, etc., will be presented in Design Memorandum No. 6, Embankments, Foundations, and Channel Improvements.

23. Concrete Flood Walls

Concrete flood walls will be provided in areas where space for dikes is lacking. There will be approximately 940 linear feet of I-wall and 5,760 linear feet of T-wall for an approximate total of 6,700 linear feet. The heights of the walls will vary from approximately 10 to 30 feet. Wall plans and typical sections are shown on Plates Nos. 3-2 through 3-14.

Detailed design of the flood walls will be presented in Design Memorandum No. 7, Detailed Design of Structures.

24. Interior Drainage

The proposed interior drainage was presented in Design Memorandum No. 1, Hydrology and Interior Drainage, dated 30 April 1965. That memorandum was approved as a basis for further planning on 16 June 1965.

25. Pumping Stations

The electric service available in the vicinity of the pumping stations is not considered sufficiently reliable to justify the use of electric motor driven pumps. The present source of power in the Ansonia-Derby area is an overhead 115 kv transmission line, backed up by an old 20,000 kw generating station. This generating station is used only for emergencies and the utility has indicated that the station may be phased out in the near future due to its low efficiency. The pumping stations will have diesel engine driven pumps. Electric service for lighting and auxiliary equipment will be obtained at secondary voltage.

The proposed pumping stations consist of the following:

a. River Street Pumping Station

Number of Pumps	2
Approximate Capacity (Each)	3,000 gpm @ 14.5 Static head
Approximate Horsepower	16
Approximate Building Size	13'-6" x 16'-6"

b. Maple Street Pumping Station

Number of Pumps	2
Approximate Capacity (Each)	18,000 gpm @ 22.5 Static head
Approximate Horsepower	145
Approximate Building Size	18'-6" x 20'-0"

c. Front Street Pumping Station

Number of Pumps	3
Approximate Capacity (Each)	19,500 gpm @ 20.0 Static head
Approximate Horsepower	120
Approximate Building Size	19'-0" x 34'-0"

d. Division Street Pumping Station

Number of Pumps	3
Approximate Capacity (Each)	20,250 gpm @ 26.0 Static head
Approximate Horsepower	185
Approximate Building Size	19'-0" x 34'-0"

Detailed design of the pumping stations will be presented in Design Memorandum No. 8, Pumping Stations.

26. Relocations

The relocations consist of sanitary sewers, water, gas, and electric lines, a minor railroad relocation, and the construction of a new Central Street Bridge.

27. Use of Consultants

The Ansonia-Derby Local Protection Project imposes no complex design problems. Technical specialists of the Office of the Chief of Engineers will be consulted and their services utilized in establishing the design criteria and the design and safety of the proposed structures and facilities.

M. SOURCES OF CONSTRUCTION MATERIAL

28. Embankments

The embankment designs for the dikes are influenced by the foundation conditions, the availability and characteristics of embankment materials, seepage control requirements, stream erosion and construction considerations, details of which will be presented in Design Memorandum No. 6, "Embankments, Foundations and Channel Improvements". Selected embankment sections which are typical for the major reaches of the dikes are shown on Plates Nos. 3-2 through 3-14.

In general, the dikes will consist of a zone of either compacted pervious fill or compacted random fill with an inclined river zone of compacted impervious fill. Some revisions may be required in the dike sections after a materials study is completed. One of the major design problems is the control of seepage through the pervious foundation soils which occur in the areas of most dike foundations. Foundation toe drains are being provided to control this seepage. A foundation cut-off through the pervious foundation soils extending to a deposit of silt is being provided for the Naugatuck River Left Bank Dike approximately between Stations 60+70 and 75+30.

29. Embankment Materials

Pervious and gravel fill materials for the construction of dikes and for drains along walls will be obtained from the required excavations for the Naugatuck River Channel and Dikes downstream from the existing Railroad Bridge. Final studies may indicate that it will be necessary for the contractor to furnish additional pervious fill material from off site sources. Random fill material will be obtained from required excavations other than described above. Gravel bedding, crushed stone, filter sand and road and stone protection materials will be furnished by the contractor from off site sources. Impervious fill material will be till or till like material obtained from a government furnished borrow area. Explorations are in progress to locate a suitable borrow area for impervious fill material.

30. Stone Protection

The river side slopes of dikes, the side slopes of new river channels and where required on the bottoms of river channels, will be protected from erosion by quarry run stone and gravel. The design details of this protection will be presented in Design Memorandum No. 6, "Embankments, Foundations and Channel Improvements."

31. Concrete Materials

In view of the relatively moderate quantity of concrete required, concrete aggregate investigation has been confined to established commercial sources. Ten commercial sources of processed sand and crushed gravel and three commercial sources of processed crushed stone are located within a twenty-mile haul distance of the project site. The New Haven Trap Rock Company and Waterbury Sand and Gravel Company have been previously tested for civil works construction. Woodbury Supply Company, Leverty and Hurley Company, D'Addario Sand and Gravel Company, Beard Sand and Gravel Company, C. W. Blakeslee and Sons, Incorporated have recently been sampled and are currently being tested. Portland cement is usually supplied to this area from one of the seven mills located in the New York Hudson River Valley or from one of the eight mills in the Pennsylvania Lehigh Valley.

N. REAL ESTATE

32. Land Requirements

The subject project will consist of both channel improvement and relocation, earthen dikes and concrete flood walls strategically located along the banks of the Naugatuck River and a tributary Beaver Brook, both of which run through the central part of the city. The project will involve commercial and industrial lands owned by private parties, the New York, New Haven and Hartford Railroad, and local interests.

The authorizing Public Law for the project requires that real estate rights necessary for construction and other project purposes be entirely provided by local interests. These costs are estimated for the purpose of providing a total project cost estimate and includes the value of land currently owned by local interests.

It is anticipated that land requirements will be acquired under a permanent easement in lieu of fee, thereby reducing severance damages.

33. Evaluation

The estimated values used in this report are based on the market data approach. Knowledge of the real estate market was obtained from

a survey and analysis of comparable sales which forms the basis for estimating the real estate costs for the subject project. Total estimated real estate costs are as follows:

Land and Improvements	$494,400
Severance Damages	137,000
Acquisition & Administrative Costs	22,000
Contingencies (10% of $653,400)	65,340
TOTAL	$718,740
ROUNDED TO:	$720,000

O. COST ESTIMATES

34. Federal First Cost

The estimated Federal first cost for the Ansonia-Derby Local Protection Project is $10,070,000. A summary of the cost of the various features of the work described in this Memorandum is shown in Table I below:

TABLE I

SUMMARY OF FEDERAL COSTS
(January 1966 Price Level)

	Project Feature	Cost
09.	Channels and Canals	$ 715,000
11.	Levees and Flood Walls	7,045,000
13.	Pumping Plants	825,000
30.	Engineering and Design	795,000
31.	Supervision and Administration	690,000
	TOTAL Estimated Federal First Costs	$10,070,000

35. Local Interests First Cost

The estimated local interests first cost in connection with the Ansonia-Derby Local Protection Project is $905,000. A summary of the cost of the various features of the work is shown in Table II below:

TABLE II

SUMMARY OF LOCAL INTERESTS COSTS
(January 1966 Price Level)

	Project Feature	Cost
01.	Lands and Damages	$720,000 *
02.	Relocations	185,000
	TOTAL Estimated Local Interests First Costs	$905,000**

* (1) Total land costs based on fair market value. Because local interests own a portion of the right-of-way, the estimated out-of-pocket land cost is $600,000.

** (2) Estimated local interests out-of-pocket first cost is $785,000.

(3) Other local costs, in project area for bridges replaced since the 1955 floods, total $1,444,000.

36. Comparison of Estimates

The following tabulation shows the comparison of the current cost estimate with the latest approved PB-3 cost estimate and with the project document estimate:

Cost Account No	Project Feature	Current Estimate (Jan 66)	PB- 3 Estimate (2 Aug 65)	Project Document Estimate (13 Apr 60)
09.	Channels & Canals	$ .715,000(1)	$ 820,000	$ 431,000
11.	Levees & Flood Walls	7,045,000(2)	6,660,000	3,530,000
13.	Pumping Plants	825,000	700,000	793,000
30.	Engineering & Design	795,000	750,000	524,000
31.	Supervision & Administration	690,000	650,000	422,000
	TOTAL FEDERAL COST	$10,070,000	$9,580,000	$5,620,000
01.	Lands and Damages	$ 720,000(3)	$ 120,000	$ 120,000
02.	Relocations	185,000	200,000	180,000
	Non-Federal Contributions	0(4)	0	80,000
	TOTAL LOCAL INTERESTS COST	$ 905,000	$ 320,000	$ 380,000
	TOTAL ESTIMATED PROJECT COST	$10,975,000	$9,900,000	$6,000,000

(1) Increase due to more stringent requirements for rock riprap channel protection based on more advanced design studies. A portion of the increase is due to higher price levels.

(2) Increase due to more complex and expensive construction based on more advanced design studies; utilizing site surveys and foundation boring data. These included flatter slopes of embankments and the need for deeper foundations for flood walls because of man-made fills and silt deposits. A portion of the increase is due to higher price levels.

(3) Following the record flood of August 1955, industrial and commercial activity in the city was in a depressed state and unemployment was high and land values low. Starting in 1960, there was an increase in economic activity in Ansonia which has continued to the present. The increased economic activity, combined with a scarcity of developable land, has resulted in higher land values.

(4) Local interests were required to furnish, in addition to lands and relocations, a cash contribution of 1.4 percent of the construction cost, estimated in the Project Document at $80,000, because of the more costly plan they desired for the River Street area. They now desire the most economic plan.

P. SCHEDULES FOR DESIGN AND CONSTRUCTION

37. Design

Plans and specifications are scheduled for completion in November 1966.

38. Construction

It is estimated that four fiscal years will be required for the construction of this project, with a construction start scheduled for March 1967.

39. Relocations

Construction of the relocations should be accomplished concurrently with the construction of the flood control project.

40. Fiscal Year 1967

A construction start will be made on the channels, levees, flood walls, and relocations.

41. Fiscal Year 1968

Construction will be initiated on the pumping plants and the work started in Fiscal Year 1967 continued.

42. Fiscal Year 1969

Continue work started in prior years.

43. Fiscal Year 1970

Continue work started in prior years and complete project by 1 January 1970.

44. Funds Required

The construction schedule is based on the assumption that funds for construction of the project will be first appropriated in Fiscal Year 1967, and that additional funds will be appropriated as required. It is, therefore, estimated that funds will be required by fiscal years approximately as follows:

Fiscal Year	Amounts Required
Through 1966	$ 600,000
1967	400,000
1968	3,400,000
1969	3,400,000
1970	2,270,000
TOTAL ESTIMATE (Federal Funds Only)	$10,070,000

Q. OPERATION AND MAINTENANCE

45. Operation and Maintenance

The flood control act requires the local interests to "maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army."

46. Annual Charges

The estimated annual cost of maintenance of the Ansonia-Derby Local Protection Project is $6,600 and the estimated annual cost of major replacement is $6,200.

R. ECONOMICS

47. Economics

Ansonia is one of the major manufacturing centers of the lower Naugatuck River Valley. For a period of three or four years following the record flood of August 1955 industrial and commercial activity in the city was in a depressed state and unemployment was high. Starting in 1960, there was an increase in economic activity in Ansonia which has continued to the present. A field review of expected flood damages in the summer of 1965 found that there has been expansion in both plant and activities in three of the major industrial complexes in the flood plain. Several new commercial ventures have been built in the flood plain and work is in progress on three public facilities. As a result of the changes, recurring 1955 flood losses, after reduction in flows by the authorized reservoir system on the Naugatuck River, have increased by over $25,000,000 since the time of the Survey Report and now total $39,700,000.

As the growth in flood losses noted occurred in areas in which the Survey Report projected enhancement there are now only flood damage prevention benefits to be credited to the project. Annual flood damage prevention benefits amount to $572,000 under current conditions in Ansonia.

TABLE III

ANNUAL CHARGES

Item	Cost	Total Cost
Federal Investment		
Federal First Cost	$10,070,000	
Interest During Construction ($10,070,000 x 0.03125 x ½ x 3)	472,030	
TOTAL FEDERAL INVESTMENT		$10,542,030
Federal Annual Charges		
Interest ($10,542,030 x 0.03125)	$ 329,440	
Amortization ($10,542,030 x 0.00151)	15,920	
TOTAL FEDERAL ANNUAL CHARGES		$ 345,360
Non-Federal Investment		
Lands & Damages	$ 720,000	
Relocations	185,000	
Total Non-Federal First Cost		$ 905,000
Interest During Construction ($905,000 x 0.03125 x ½ x 3)		42,420
TOTAL NON-FEDERAL INVESTMENT		$ 947,420
Non-Federal Annual Charges		
Interest ($947,420 x 0.03125)	$ 29,610	
Amortization ($947,420 x 0.00151)	1,430	
Maintenance & Operation	6,600	
Interim Replacements	6,200	
TOTAL NON-FEDERAL ANNUAL CHARGES		43,840
TOTAL ANNUAL CHARGES		$ 389,200
Annual Benefits		
Flood Damage Prevention		$ 572,000

48. Benefit-Cost Ratio

$$\frac{\text{Benefits}}{\text{Costs}} = \frac{\$572,000}{\$389,200} = 1.5$$

S. RECOMMENDATION

49. Recommendation

It is recommended that the project plan submitted in this memorandum be approved as a basis for preparation of Detailed Design Memoranda and contract plans for the Ansonia-Derby Local Protection Project.

TABLE IV

DETAILED COST ESTIMATE
(January 1966 Price Level)

	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
01.	LANDS, DAMAGES & ACQUISITION (Local Interests Cost)				
	TOTAL LANDS, DAMAGES & ACQUISITION				$ 720,000
02.	RELOCATIONS (Local Interests Cost)				
	30" Sanitary Sewer Siphon (incl. inlet & outlet struct. with sluice gate)	1	L.S.	$35,000.00	35,000
	15" Sanitary Sewer Siphon (under storm drain pressure conduit in Farrel Corp. yard)	1	L.S.	1,200.00	1,200
	Sanitary Sewer Siphons (under Beaver Brook)	2	Each	1,500.00	3,000
	Relocate Sanitary Sewer (Ansonia Manf. Co)	1	L.S.	500.00	500
	Relocate Sanitary, Gas & Waterlines (Main St. & Beaver Brook Conduit)	1	L.S.	1,000.00	1,000
	Relocate 12" Waterline (E. Bank S. of Maple Street Bridge)	1	L.S.	600.00	600
	Lower 4" gas & 6" & 8" Waterlines (Beaver Brook @ Central Street)	1	L.S.	1,000.00	1,000
	Relocate 8" gas & 10" Waterlines (River St. near flood wall)	1	L.S.	12,000.00	12,000
	Relocate Hydrant & Valve (@ Station 9+50)	1	L.S.	100.00	100
	Relocate 3" Gas & 8" Waterlines (3rd St. for 36" S.D.)	1	L.S.	3,000.00	3,000
	Relocate 6" Gas Main & Meter House (S. of Bridge St. @ flood wall)	1	L.S.	2,500.00	2,500
	Relocate Sanitary Sewer (@ R.R. Gate #3)	1	L.S.	1,500.00	1,500
	Relocate 24" CI Sewer & Sluice Gate (@ R.R. Gate #4)	1	L.S.	8,000.00	8,000
	Electrical Relocations	1	Job	L.S.	32,000

TABLE IV (Cont)

Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
02. RELOCATIONS (Local Interests Cost) (Cont)				
Railroad Relocations	1,600	L.F.	$ 5.00	$ 8,000
Central Street Bridge				
Structural Steel	8	Ton	400.00	3,200
Concrete (Reinf)	126	C.Y.	65.00	8,190
Grate Deck Steel	200	S.Y.	65.00	13,000
Approach Paving	200	S.Y.	5.00	1,000
Sidewalks (8' wide)	120	L.F.	15.00	1,800
Guard Rail	60	L.F.	5.00	300
		Sub-Total		$ 136,890
		Contingencies		22,110
		Sub-Total		$ 159,000
		Engineering & Design		13,000
		Supervision & Administration		13,000
TOTAL, RELOCATIONS (Local Interests Cost)				$ 185,000
09. CHANNELS & CANALS (Federal Cost)				
Excavation, General	330,000	C.Y.	$ .80	$ 264,000
Excavation, Stream Deflector	200	C.Y.	15.00	3,000
Pumping	1	Job	L.S.	5,000
Concrete (Reinf)	1,670	C.Y.	70.00	116,900
Concrete (Mass)	500	C.Y.	40.00	20,000
Steel Sheeting (Temp)	3,100	S.F.	3.00	9,300
Stone, Rip Rap	19,000	C.Y.	8.50	161,500
Gravel Bedding	11,000	C.Y.	2.50	27,500
Gravel, Channel Prot.	6,000	C.Y.	2.50	15,000
		Sub-Total		$ 622,200
		Contingencies		93,800
TOTAL, CHANNELS & CANALS (Federal Cost)				$ 716,000
11. LEVEES & FLOOD WALLS (Federal Cost)				
Site Preparation	45	Acre	$100.00	$ 4,500
Stream Control	1	Job	L.S.	50,000
Building Removal	1	Job	L.S.	15,000

TABLE IV (Cont)

	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
11.	LEVEES & FLOOD WALLS (Federal Cost)(Cont)				
	Concrete Removal	1	Job	L.S.	$ 4,000
	R.R. Track Removal	1	Job	L.S.	2,000
	R.R. Trestle Removal	1	Job	L.S.	2,000
	Excavation, General	265,000	C.Y.	.80	212,000
	Excavation, Structural	76,000	C.Y.	1.00	76,000
	Impervious Borrow	250,000	C.Y.	1.60	400,000
	Impervious Fill, Comp.	160,000	C.Y.	.35	56,000
	Pervious Borrow	100,000	C.Y.	1.60	160,000
	Pervious Fill, Comp.	275,000	C.Y.	.35	96,250
	Random Fill, Comp.	50,000	C.Y.	.35	17,500
	Gravel Fill, Comp.	20,000	C.Y.	1.85	37,000
	Filter Sand	10,000	C.Y.	1.85	18,500
	Filter Stone	5,100	C.Y.	8.50	43,350
	Crushed Stone Fill, Compacted	55,000	C.Y.	8.50	467,500
	Backfill, Compacted	75,000	C.Y.	.40	30,000
	Gravel Bedding	39,000	C.Y.	1.85	72,150
	Stone Slope Protection	67,000	C.Y.	8.50	569,500
	Concrete, T-Walls	24,300	C.Y.	45.00	1,093,500
	Concrete, I-Wall	475	C.Y.	45.00	21,380
	Concrete, Conduits	3,800	C.Y.	45.00	171,000
	Concrete, Stilling Basin	800	C.Y.	45.00	36,000
	Cement	48,000	Bbl.	5.00	240,000
	Steel Reinforcement	3,626,000	Lbs.	.15	543,900
	Steel Sheet Piling, I-Wall	16,400	S.F.	4.20	68,880
	Sheeting, Left in Place	70,000	S.F.	4.20	294,000
	Sheeting, Pulled	7,500	S.F.	3.00	22,500
	Street Gates	1,360	S.F.	85.00	115,600
	R.R. Gates	1,770	S.F.	85.00	150,450
	Chain Link Fence, 4 Feet	200	L.F.	3.00	600
	Road Gravel	2,400	C.Y.	1.50	3,600
	Bit. Conc. Pavement	7,000	S.Y.	2.50	17,500
	P. C. Conc.Pavement	200	S.Y.	8.00	1,600
	Topsoiling	16,000	C.Y.	3.00	48,000
	Seeding	15	Acre	500.00	7,500
	Storm Drains				
	6" R.C.	65	L.F.	4.00	260
	12" R.C.	1,723	L.F.	8.00	13,780
	18" R.C.	425	L.F.	11.25	4,780
	24" R.C.	1,665	L.F.	15.00	24,980
	30" R.C.	1,640	L.F.	20.00	32,800

TABLE IV (Cont)

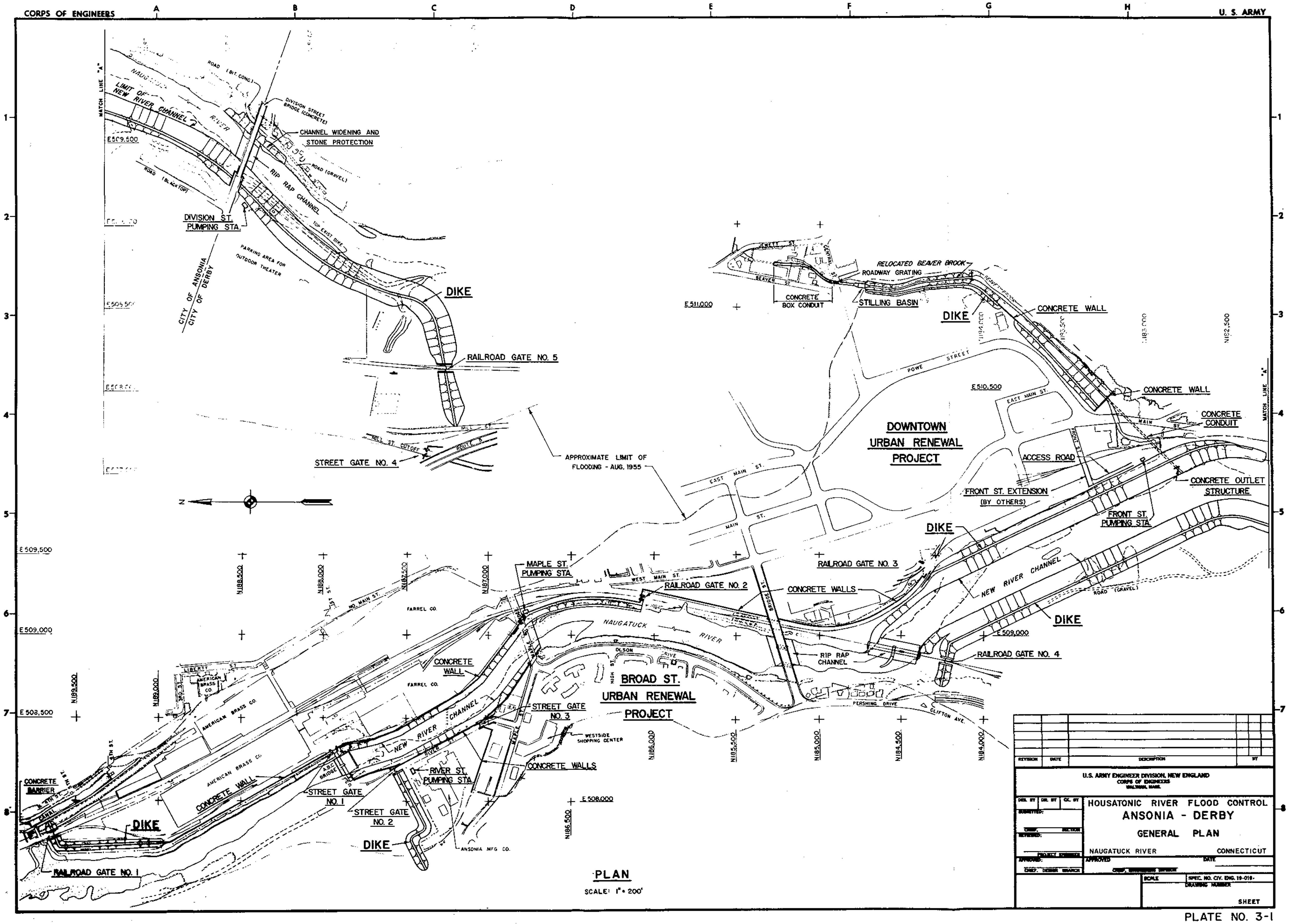
Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
11. LEVEES & FLOOD WALLS (Federal Cost)(Cont)				
Storm Drains (Cont)				
36" R.C.	1,185	L.F.	$ 25.00	$ 29,630
42" R.C.	1,595	L.F.	30.00	47,850
48" R.C.	2,935	L.F.	40.00	117,400
54" R.C.	755	L.F.	50.00	37,750
60" R.C.	1,975	L.F.	55.00	108,630
72" R.C.	365	L.F.	70.00	25,550
Standard Drain Manholes	55	Ea.	700.00	38,500
Curb Inlet	1	Ea.	700.00	700
Special Manholes	5	Ea.	5,000.00	25,000
Trench Grating Structures	120	L.F.	50.00	6,000
Plug Tailrace @ Sta. 33+00	1	L.S.	600.00	600
Reinforced Concrete Aprons	2	Ea.	2,000.00	4,000
Modifications to Exist. Manholes	2	Ea.	150.00	300
Paved Gutter	1	Ea.	350.00	350
Drainage Ditch & Intake Structure	1	L.S.	3,000.00	3,000
Sluice Gate Structures				
72"	2	Ea.	25,000.00	50,000
60"	2	Ea.	20,000.00	40,000
48"	1	Ea.	15,000.00	15,000
36"	1	Ea.	10,000.00	10,000
24"	2	Ea.	5,000.00	10,000
Connect. Exist. S.D's to New Drain Manholes	15	Ea.	50.00	750
Under Drains				
6" BCCM	8,240	L.F.	3.00	24,720
8" BCCM	4,325	L.F.	4.00	17,300
10" BCCM	1,477	L.F.	5.00	7,390
12" BCCM	1,218	L.F.	6.00	7,310
15" BCCM	895	L.F.	7.00	6,270
Under Drain Manholes	19	Ea.	250.00	4,750
Observation Risers	49	Ea.	100.00	4,900
Pressure Conduits, Storm				
60" R.C.	1,210	L.F.	75.00	90,750
48" R.C.	1,618	L.F.	54.00	87,370
42" R.C.	520	L.F.	42.00	21,840
36" R.C.	405	L.F.	36.00	14,580

TABLE IV (Cont)

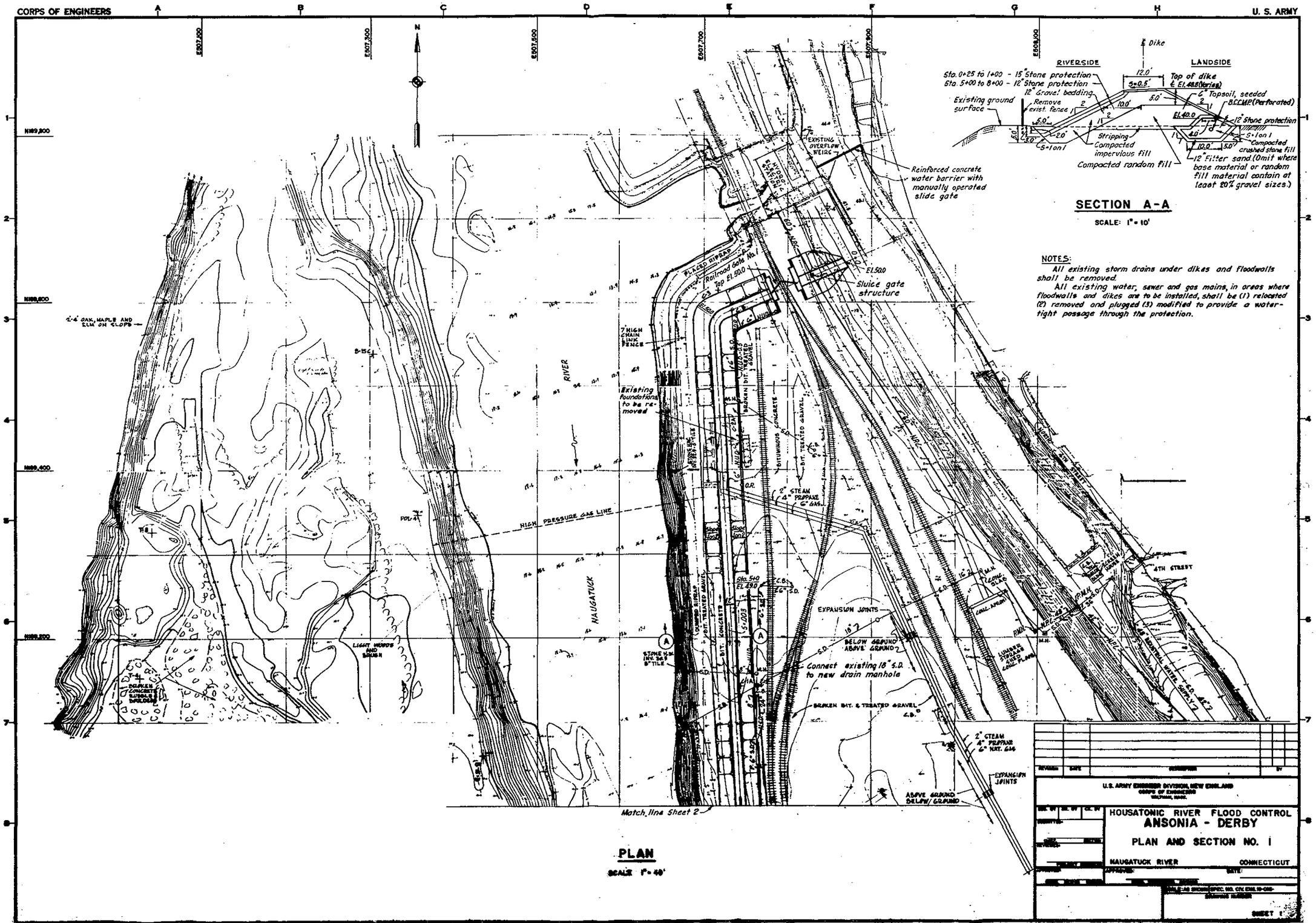
	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
11.	LEVEES & FLOOD WALLS (Federal Cost)(Cont)				
	Pressure Manholes, Storm	12	Ea.	$1,000.00	$ 12,000
	Remove Exist. Utility Lines under Protection	1,670	L.F.	2.00	3,340
	Connect Exist. S D to New Interceptor S.D.	18	Ea.	50.00	900
	RC Barrier for Headrace at Hydro Plant	1	Job	L.S.	6,000
			Sub-Total		$ 6,126,290
			Contingencies		918,710
	TOTAL, LEVEES AND FLOOD WALLS (Federal Cost)				$ 7,045,000
13.	PUMPING PLANTS (Federal Cost)				
	River Street Station	1	Job	L.S.	$ 43,000
	Maple Street Station	1	Job	L.S.	174,000
	Front Street Station	1	Job	L.S.	235,000
	Division Street Station	1	Job	L.S.	265,000
			Sub-Total		$ 717,000
			Contingencies		108,000
	TOTAL, PUMPING PLANTS (Federal Cost)				$ 825,000
30.	ENGINEERING AND DESIGN (Federal Cost)				$ 795,000
31.	SUPERVISION AND ADMINISTRATION (Federal Cost)				$ 690,000

SUMMARY OF FIRST COSTS

Estimated Federal First Costs	$10,070,000
Estimated Local Interests First Costs	905,000
TOTAL ESTIMATED PROJECT COST	$10,975,000


CORPS OF ENGINEERS
U. S. ARMY
DIVISION STREET BRIDGE (CONCRETE)
CHANNEL WIDENING AND STONE PROTECTION
RIP RAP CHANNEL
DIVISION ST. PUMPING STA.
CITY OF ANSONIA
CITY OF DERBY
LIMIT OF NEW RIVER CHANNEL
PARKING AREA FOR OUTDOOR THEATER
DIKE
RAILROAD GATE NO. 5
STREET GATE NO. 4
APPROXIMATE LIMIT OF FLOODING - AUG. 1955
RELOCATED BEAVER BROOK
ROADWAY GRATING
CONCRETE BOX CONDUIT
STILLING BASIN
CONCRETE WALL
POWE STREET
DOWNTOWN URBAN RENEWAL PROJECT
CONCRETE CONDUIT
ACCESS ROAD
CONCRETE OUTLET STRUCTURE
FRONT ST. EXTENSION (BY OTHERS)
FRONT ST. PUMPING STA.
EAST MAIN ST.
MAIN ST.
RAILROAD GATE NO. 3
MAPLE ST. PUMPING STA.
RAILROAD GATE NO. 2
CONCRETE WALLS
NEW RIVER CHANNEL
NAUGATUCK RIVER
RIP RAP CHANNEL
RAILROAD GATE NO. 4
BROAD ST. URBAN RENEWAL PROJECT
STREET GATE NO. 3
WESTSIDE SHOPPING CENTER
PERSHING DRIVE
CLIFTON AVE.
FARREL CO.
AMERICAN BRASS CO.
CONCRETE WALL
CONCRETE BARRIER
STREET GATE NO. 1
STREET GATE NO. 2
RIVER ST. PUMPING STA.
ANSONIA MFG CO.
RAILROAD GATE NO. 1
PLAN
SCALE: 1" = 200'
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
GENERAL PLAN
NAUGATUCK RIVER
CONNECTICUT
PLATE NO. 3-1

CORPS OF ENGINEERS — U. S. ARMY



SECTION A-A

SCALE: 1" = 10'

NOTES:

All existing storm drains under dikes and floodwalls shall be removed.

All existing water, sewer and gas mains, in areas where floodwalls and dikes are to be installed, shall be (1) relocated (2) removed and plugged (3) modified to provide a water-tight passage through the protection.

PLAN

SCALE 1" = 40'

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

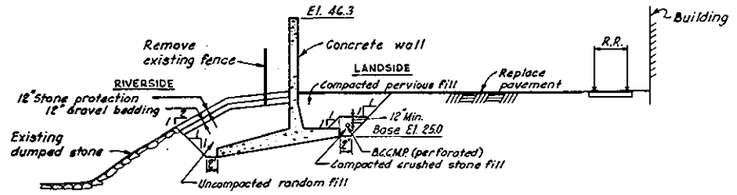
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTION NO. 1
NAUGATUCK RIVER CONNECTICUT

APPROVED: DATE:

SHEET 1

PLATE NO. 3-2

CORPS OF ENGINEERS — U. S. ARMY



SECTION B-B

SCALE: 1" = 10'

PLAN

SCALE: 1" = 40'

SECTION C-C

SCALE: 1" = 10'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

CHIEF, ENGINEERING DIVISION

APPROVED — DATE

CHIEF, CONSTRUCTION DIVISION

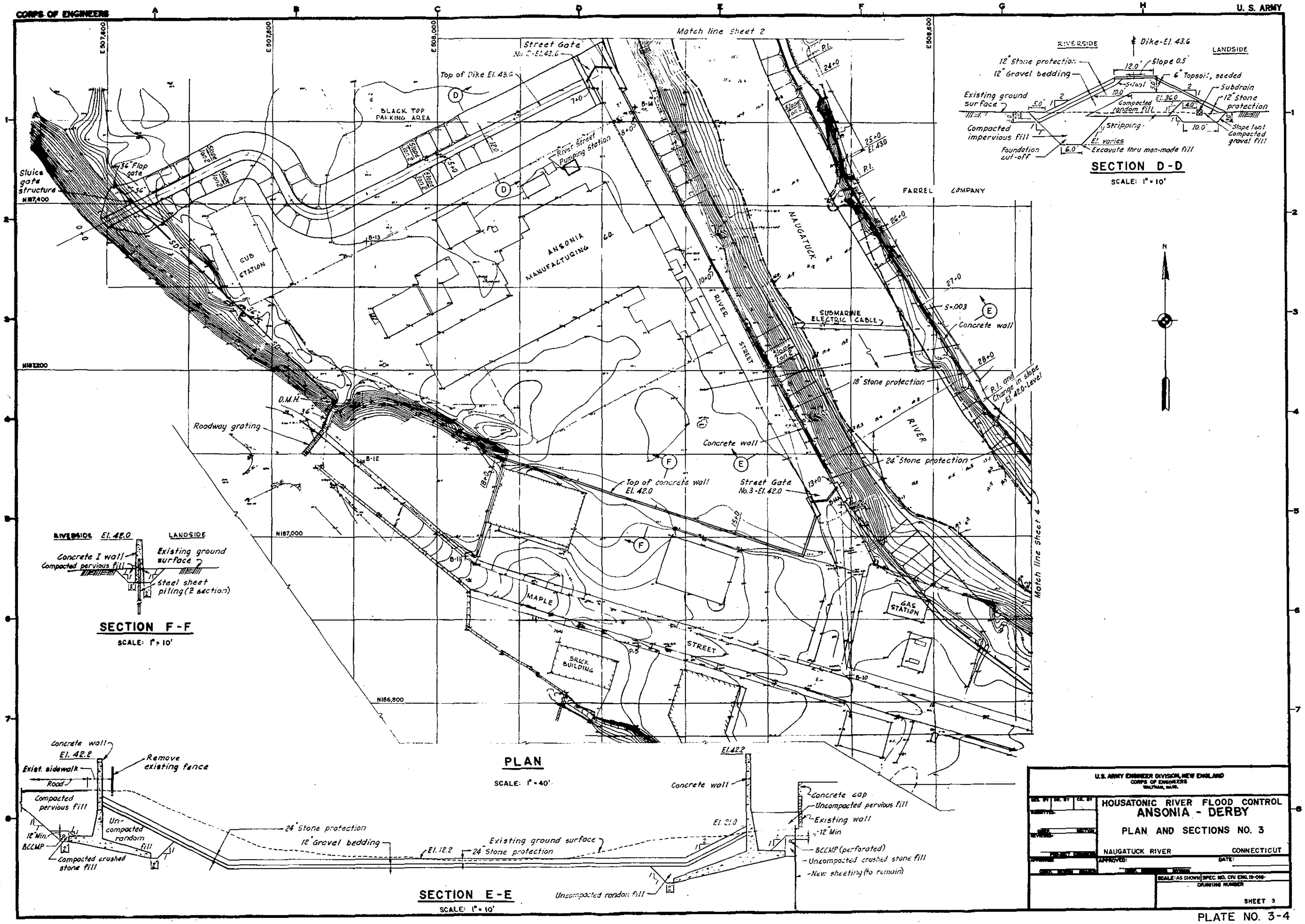
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 2

NAUGATUCK RIVER — CONNECTICUT

SCALE AS SHOWN | SPEC. NO. CIV. ENG. 19-016-
DRAWING NUMBER

SHEET 2

PLATE NO. 3-3

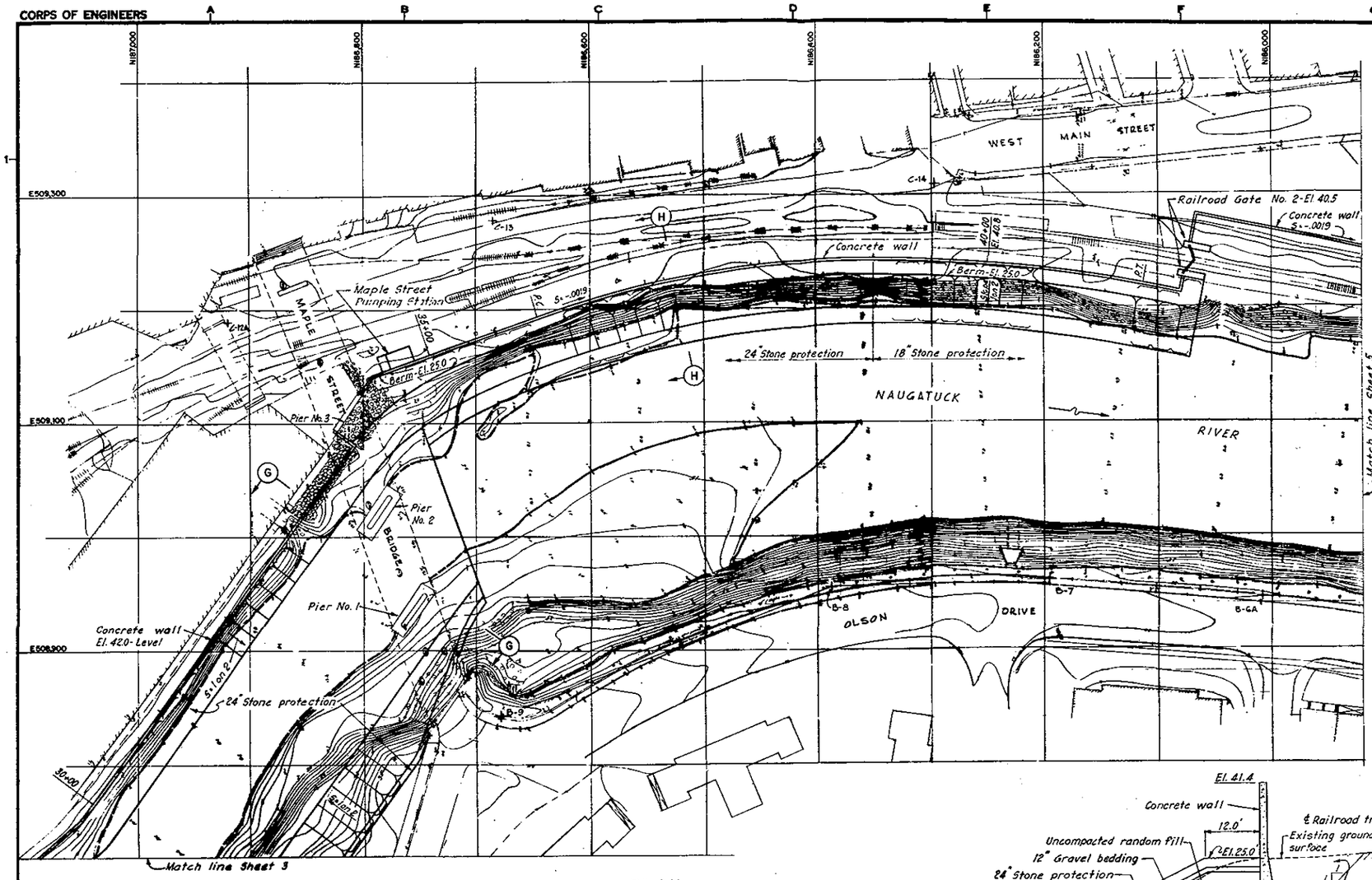


CORPS OF ENGINEERS
U. S. ARMY
Match line sheet 2
Street Gate No. 2-El. 43.6
Top of Dike El. 43.6
BLACK TOP PARKING AREA
River Street Pumping Station
Sluice gate structure
36" Flap gate
SUB STATION
ANSONIA MANUFACTURING CO.
NAUGATUCK
RIVER STREET
FARREL COMPANY
SUBMARINE ELECTRIC CABLE
Concrete wall
18" Stone protection
P.I. and Change in slope El. 42.0-Level
RIVER
24" Stone protection
D.M.H.
Roadway grating
Concrete wall
Top of concrete wall El. 42.0
Street Gate No. 3-El. 42.0
MAPLE STREET
GAS STATION
BRICK BUILDING
Match line Sheet 4
PLAN
SCALE: 1" = 40'
RIVERSIDE
Dike-El. 43.6
LANDSIDE
12" Stone protection
12" Gravel bedding
Slope 0.5
6" Topsoil, seeded
Subdrain
12" Stone protection
Existing ground surface
Compacted random fill
Compacted impervious fill
Stripping
El. varies
Foundation cut-off
Excavate thru man-made fill
Slope face Compacted gravel fill
SECTION D-D
SCALE: 1" = 10'
RIVERSIDE El. 42.0 LANDSIDE
Concrete I wall
Compacted pervious fill
Existing ground surface
Steel sheet piling (Z section)
SECTION F-F
SCALE: 1" = 10'
Concrete wall El. 42.2
Exist. sidewalk
Road
Remove existing fence
Compacted pervious fill
12" Min.
BCCMP
Un-compacted random fill
Compacted crushed stone fill
24" Stone protection
12" Gravel bedding
Existing ground surface
El. 12.2
24" Stone protection
El. 42.2
Concrete wall
El. 21.0
Concrete cap
Uncompacted pervious fill
Existing wall
12" Min
BCCMP (perforated)
Uncompacted crushed stone fill
New sheeting (to remain)
Uncompacted random fill
SECTION E-E
SCALE: 1" = 10'
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 3
NAUGATUCK RIVER
CONNECTICUT
SCALE: AS SHOWN
SHEET 3

PLATE NO. 3-4

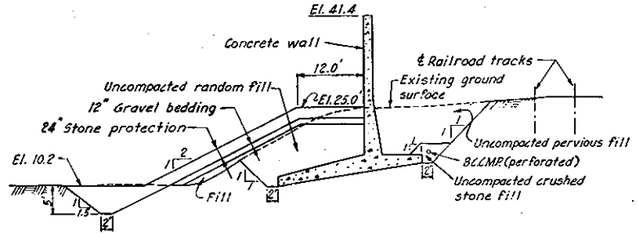
CORPS OF ENGINEERS

U. S. ARMY



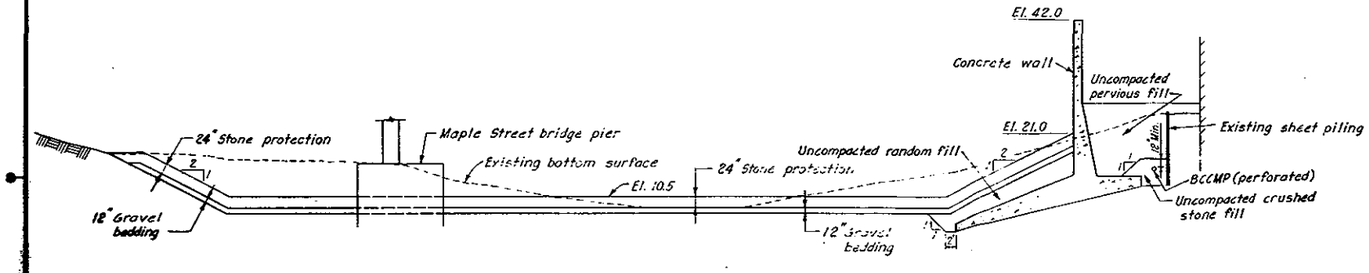
PLAN

SCALE: 1" = 40'



SECTION H-H

SCALE: 1" = 10'



SECTION G-G

SCALE: 1" = 10'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED:

CHIEF, ENGINEERING DIVISION

CHIEF, DESIGN BRANCH

PROJECT ENGINEER

APPROVED:

CHIEF, ENGINEERING DIVISION

CHIEF, DESIGN BRANCH

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY

PLAN AND SECTIONS NO. 4

NAUGATUCK RIVER — CONNECTICUT

APPROVED: DATE:

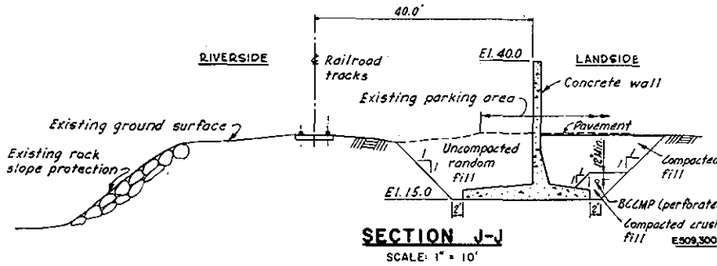
SCALE: AS SHOWN | SPEC. NO. CIV. ENG. 19-056-

DRAWING NUMBER

SHEET 4

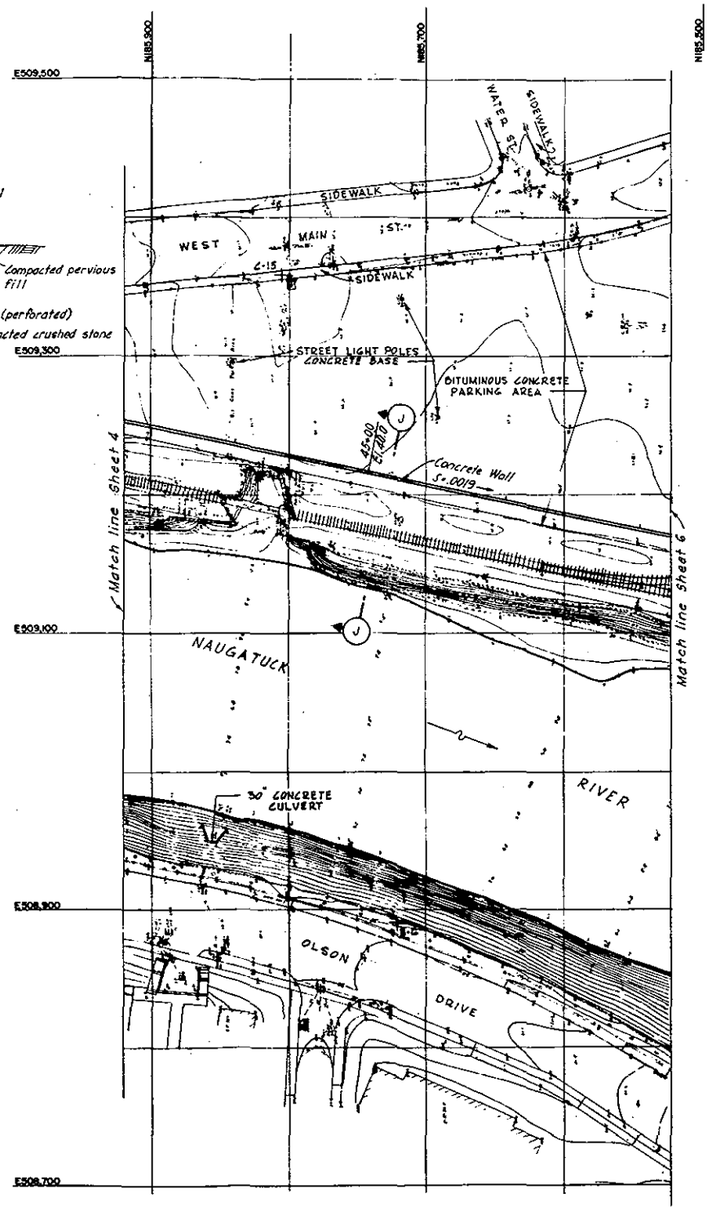
PLATE NO. 3-5

CORPS OF ENGINEERS — U. S. ARMY



SECTION J-J

SCALE: 1" = 10'



PLAN

SCALE: 1" = 40'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED:

CHIEF, SECTION

REVIEWED:

PROJECT ENGINEER

APPROVED:

CHIEF, BRANCH | DIVISION

CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTION NO. 5

NAUGATUCK RIVER — CONNECTICUT

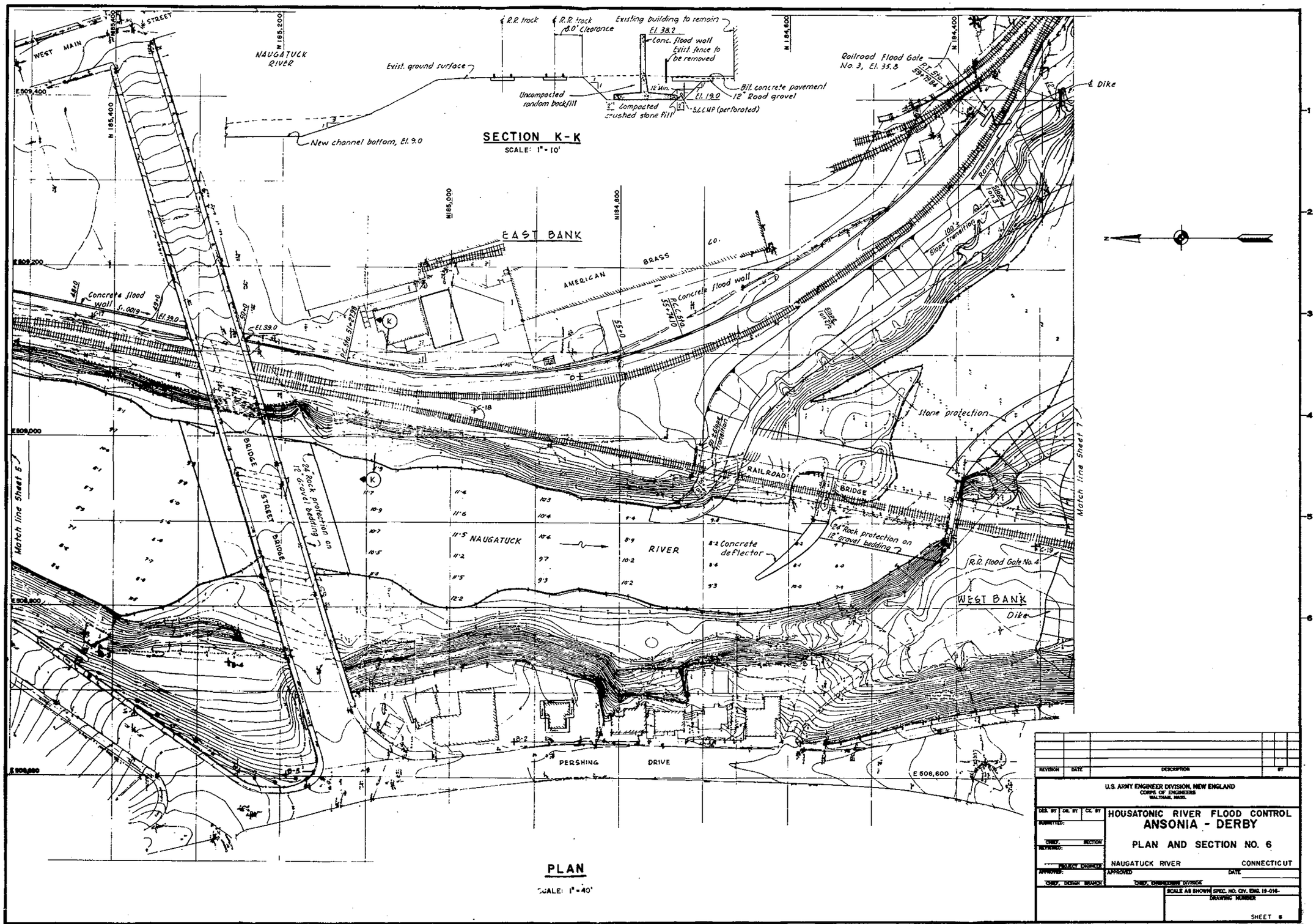
APPROVED: DATE:

SCALE: AS SHOWN | SPEC. NO. CIV ENG 19-060-

DRAWING NUMBER

SHEET 6

PLATE NO. 3-6



REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED: CHIEF, SECTION

REVISED: PROJECT ENGINEER

APPROVED: CHIEF, DESIGN BRANCH

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTION NO. 6

NAUGATUCK RIVER CONNECTICUT

APPROVED DATE

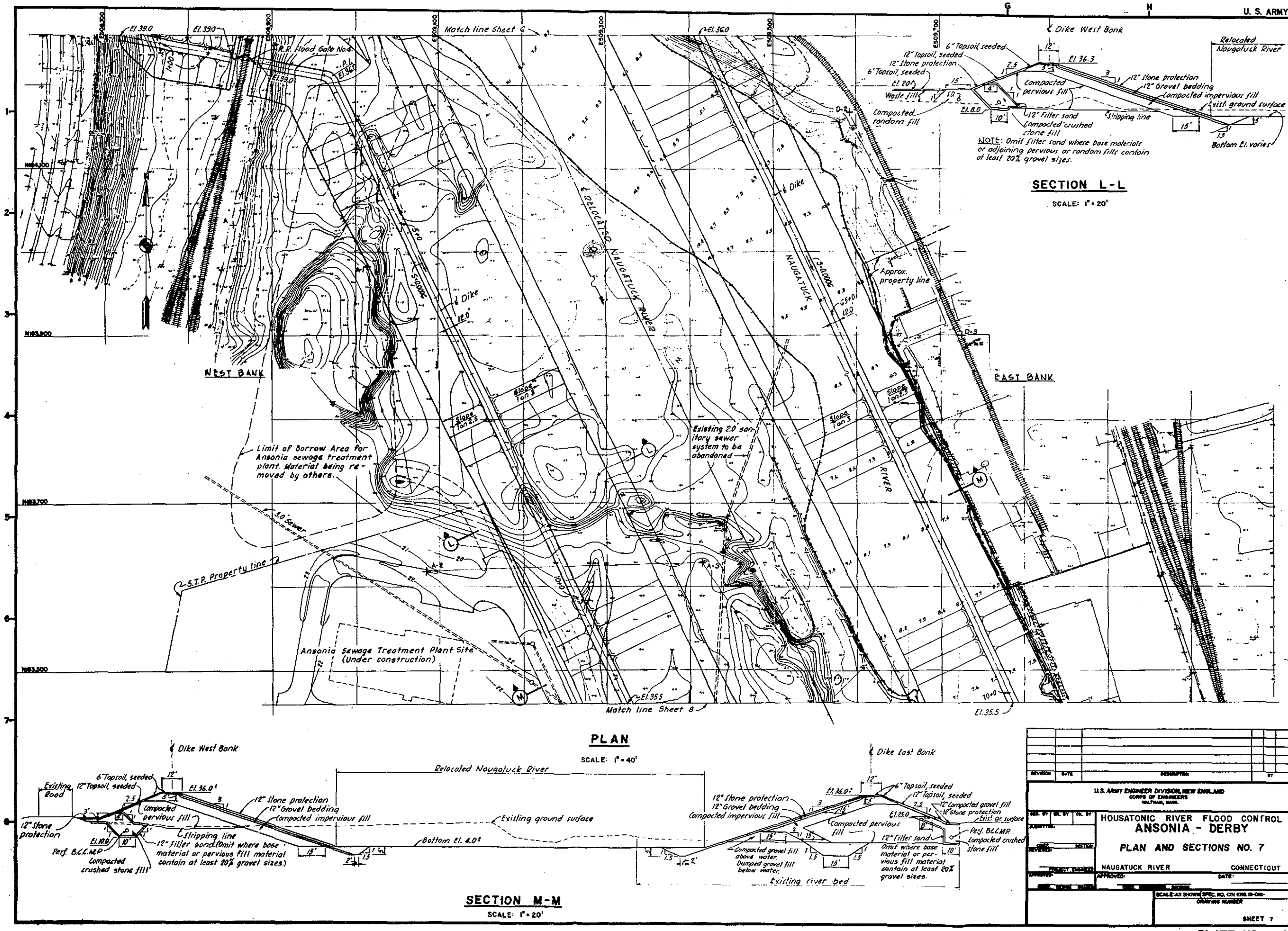
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO. CIV. ENG. 19-016-

DRAWING NUMBER

SHEET 6

PLATE NO. 3-7



REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 7
NAUGATUCK RIVER — CONNECTICUT

SHEET 7

PLATE NO. 3-8

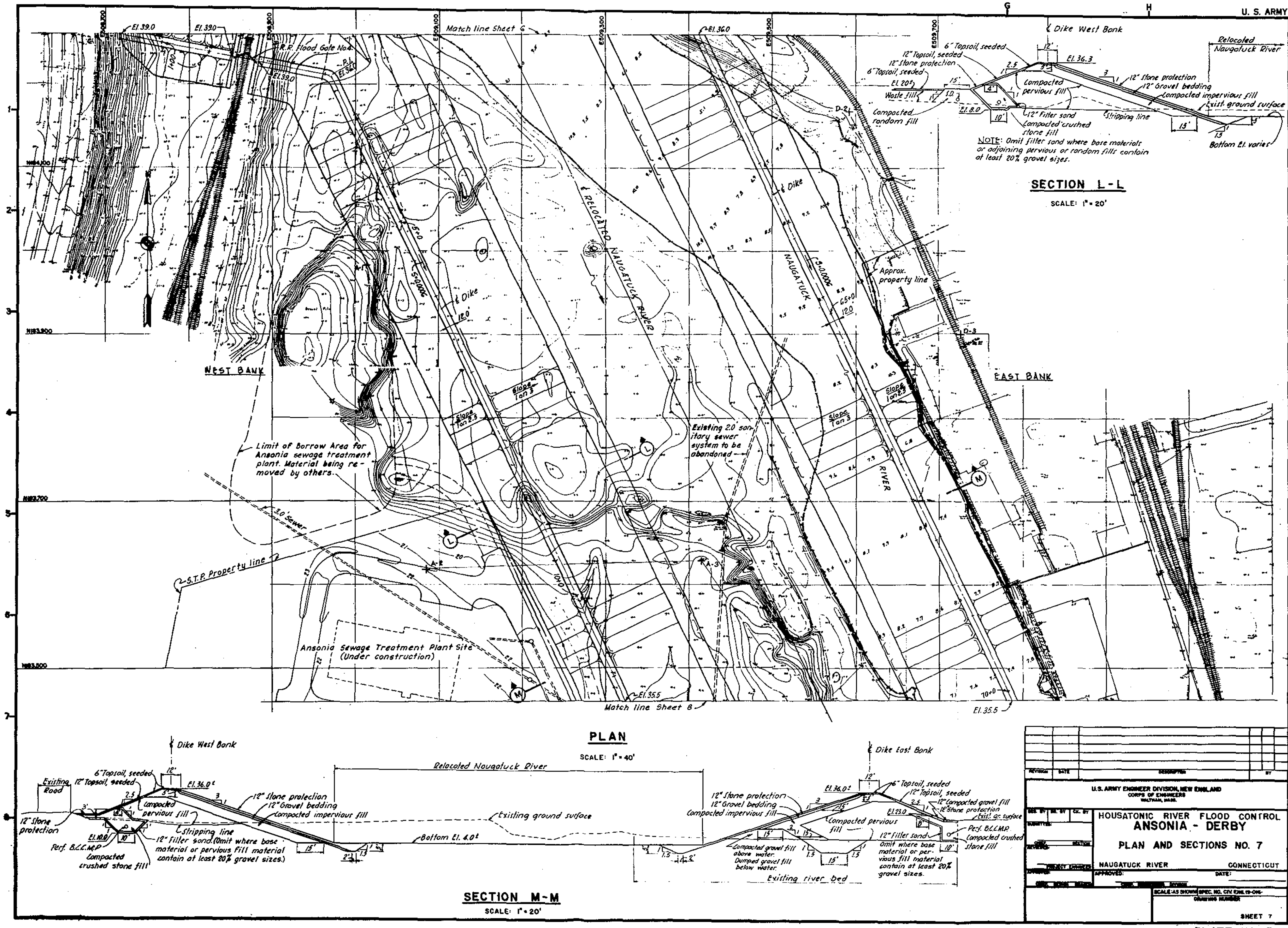
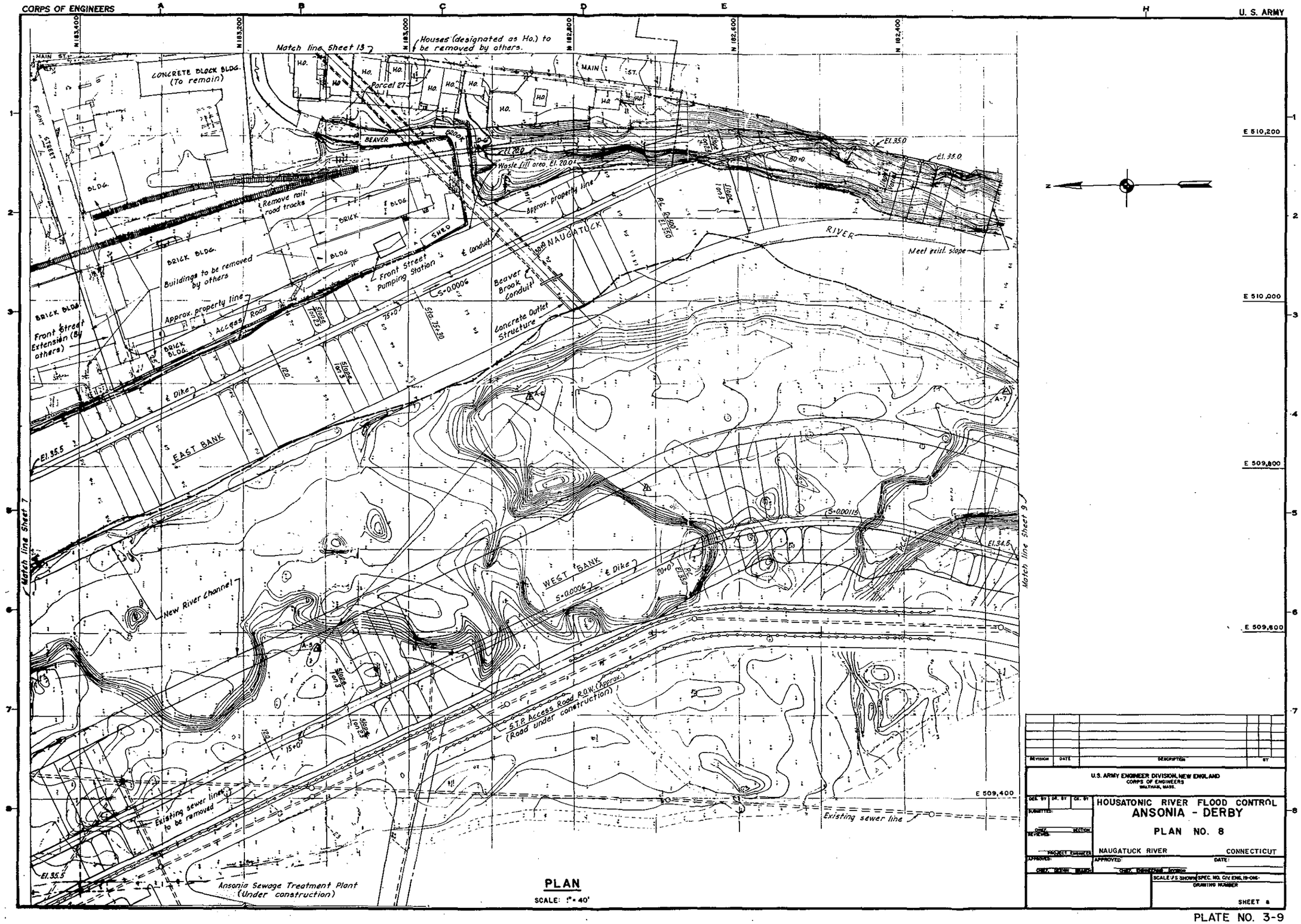

U. S. ARMY
Match line Sheet 6
Match line Sheet 8
R.R. Flood Gate No. 4
WEST BANK
EAST BANK
RELOCATED NAUGATUCK RIVER
NAUGATUCK RIVER
Dike
Approx. property line
Limit of Borrow Area for Ansonia sewage treatment plant. Material being removed by others.
Existing 2.0 sanitary sewer system to be abandoned
3.0' Sewer
S.T.P. Property line
Ansonia Sewage Treatment Plant Site (Under construction)
El. 35.5
PLAN
SCALE: 1" = 40'
Dike West Bank
Relocated Naugatuck River
6" Topsoil, seeded
12" Topsoil, seeded
12" Stone protection
12" Gravel bedding
Compacted pervious fill
Compacted impervious fill
Compacted random fill
Waste fill
12" Filter sand
Compacted crushed stone fill
Stripping line
Exist. ground surface
Bottom El. varies
NOTE: Omit filler sand where base materials or adjoining pervious or random fills contain at least 20% gravel sizes.
SECTION L-L
SCALE: 1" = 20'
Existing Road
12" Stone protection
Perf. B.C.C.M.P.
12" Filter sand (Omit where base material or pervious fill material contain at least 20% gravel sizes.)
Existing ground surface
Bottom El. 4.0±
Dike East Bank
Compacted gravel fill above water
Dumped gravel fill below water
Existing river bed
SECTION M-M
SCALE: 1" = 20'
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 7
NAUGATUCK RIVER
CONNECTICUT
SHEET 7

PLATE NO. 3-8

CORPS OF ENGINEERS

U. S. ARMY



PLAN

SCALE: 1" = 40'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED:

CHIEF, SECTION

PROJECT ENGINEER

APPROVED:

CHIEF, DESIGN BRANCH

APPROVED: DATE:

CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN NO. 8
NAUGATUCK RIVER CONNECTICUT

SCALE: AS SHOWN | SPEC. NO. CIV ENG. 19-046-

DRAWING NUMBER

SHEET 8

PLATE NO. 3-9

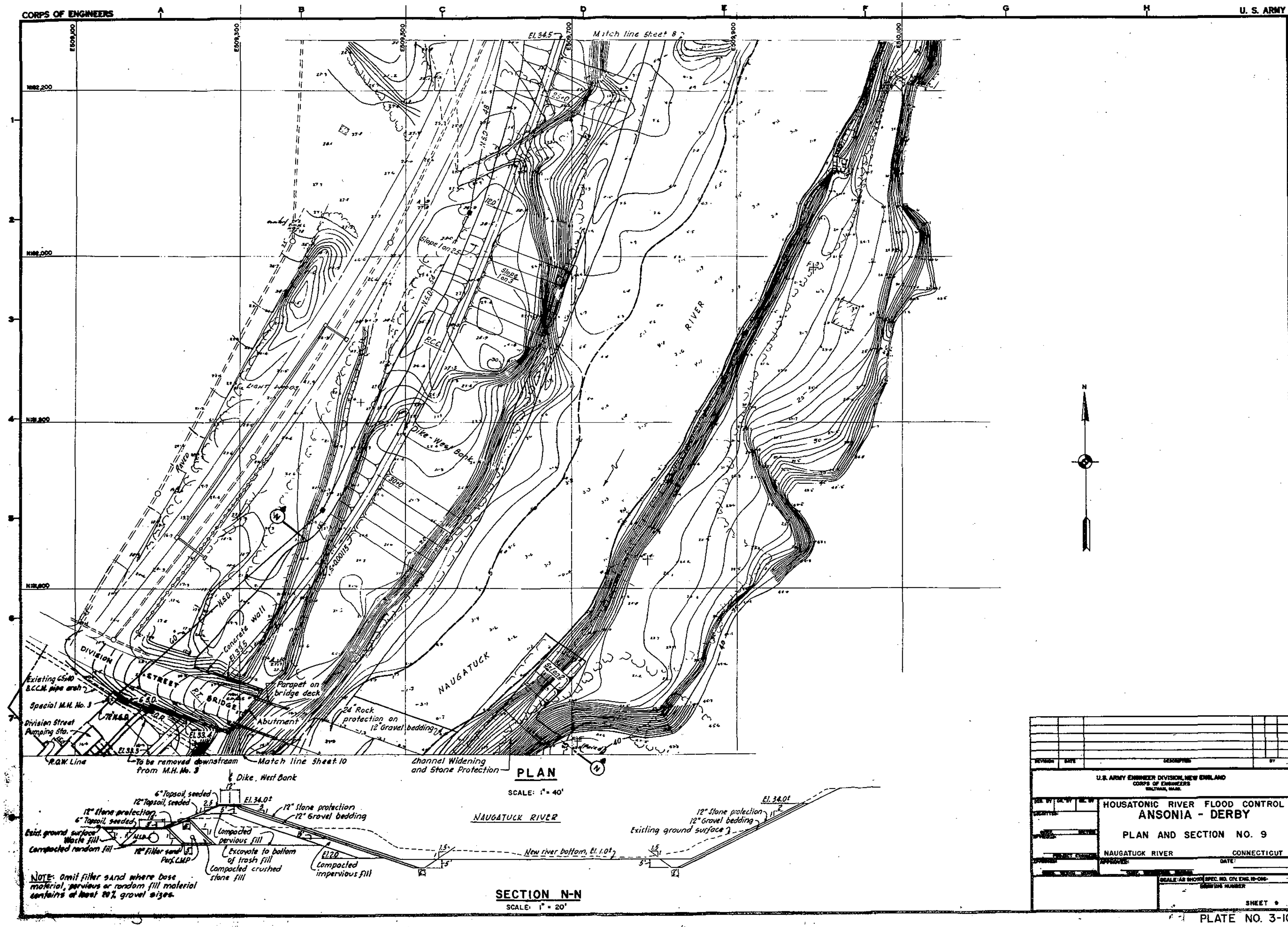
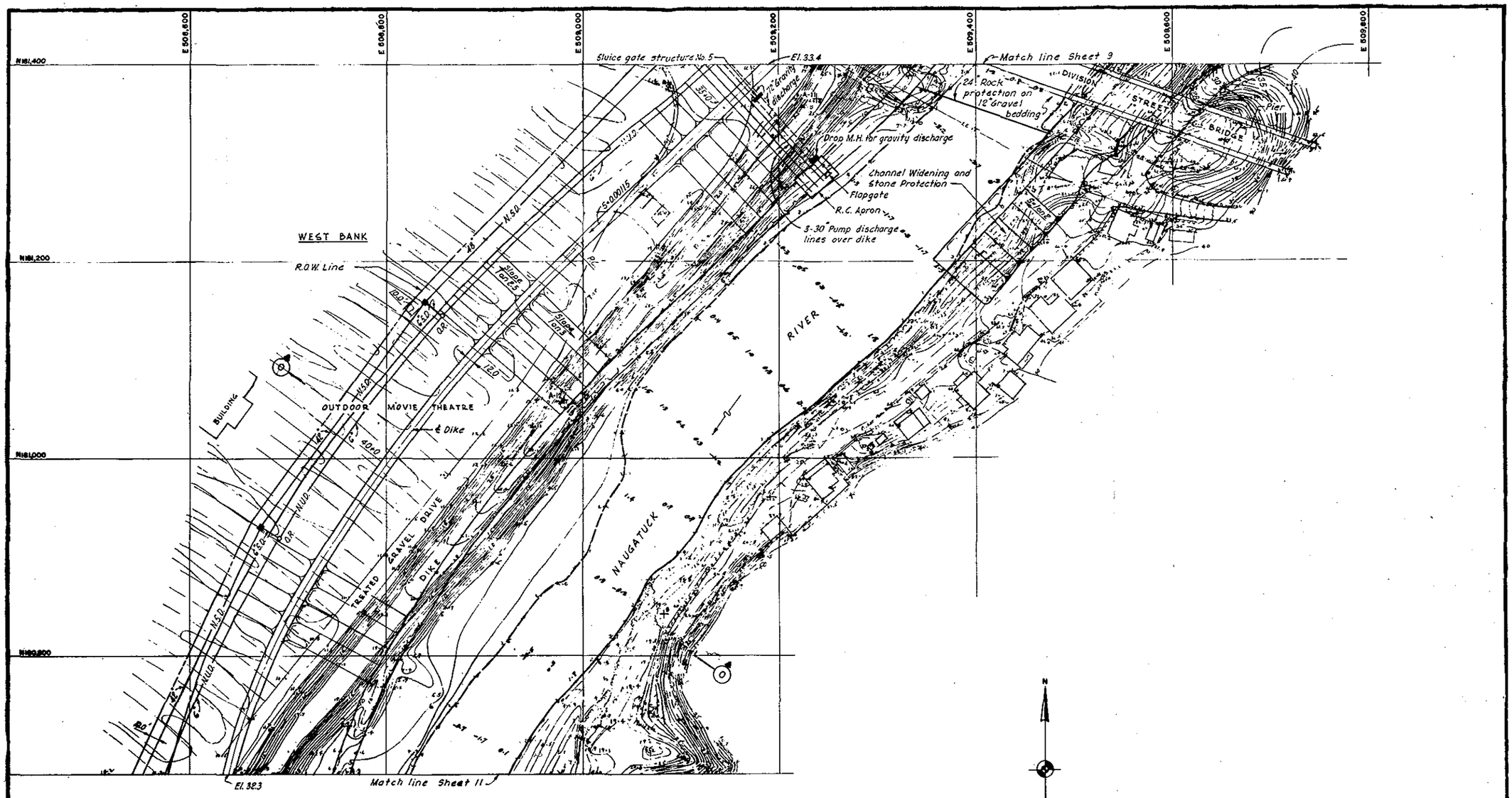
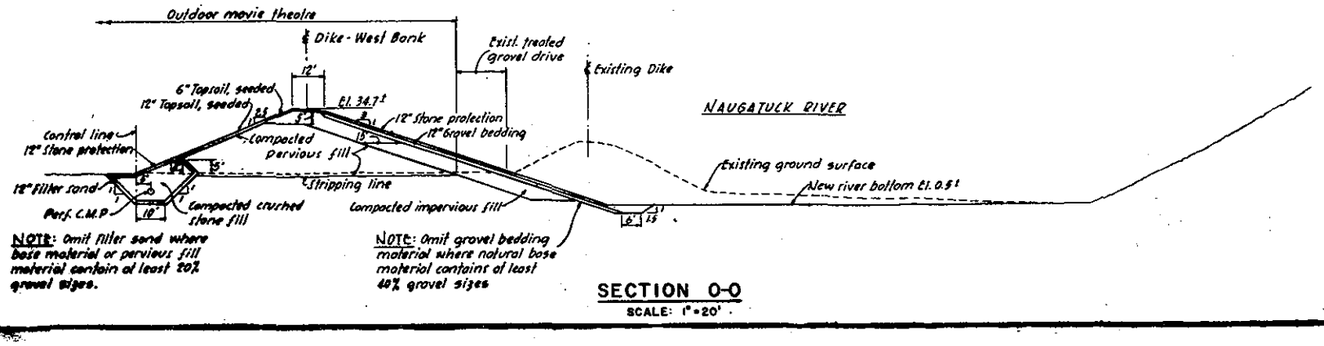

CORPS OF ENGINEERS
U. S. ARMY
Match line Sheet 8
El. 34.5
Slope 1 on 2.5
Slope 1 on 3
RIVER
NAUGATUCK
Dike - West Bank
Concrete Wall
El. 33.5
DIVISION STREET BRIDGE
Existing 65x40 B.C.C.M. pipe arch
Special M.H. No. 3
Division Street Pumping Sta.
Parapet on bridge deck
Abutment
24" Rock protection on 12" Gravel bedding
R.O.W. Line
To be removed downstream from M.H. No. 3
Match line Sheet 10
Channel Widening and Stone Protection
PLAN
SCALE: 1" = 40'
Dike, West Bank
6" Topsoil, seeded
12" Topsoil, seeded
12" Stone protection
6" Topsoil, seeded
Exist. ground surface
Waste fill
Compacted random fill
12" Filter sand
Perf. C.M.P.
El. 34.0±
12" Stone protection
12" Gravel bedding
Compacted pervious fill
Excavate to bottom of trash fill
Compacted crushed stone fill
El. 12.0
Compacted impervious fill
NAUGATUCK RIVER
New river bottom, El. 1.0±
12" Stone protection
12" Gravel bedding
Existing ground surface
El. 34.0±
NOTE: Omit filter sand where base material, pervious or random fill material contains at least 30% gravel sizes.
SECTION N-N
SCALE: 1" = 20'
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTION NO. 9
NAUGATUCK RIVER
CONNECTICUT
SHEET 9

PLATE NO. 3-10



PLAN

SCALE: 1" = 40'



SECTION O-O

SCALE: 1" = 20'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED:

CHIEF, BRANCH

REVIEWED:

PROJECT ENGINEER

APPROVED:

CHIEF, DESIGN BRANCH

APPROVED DATE:

CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY

PLAN AND SECTION NO. 10

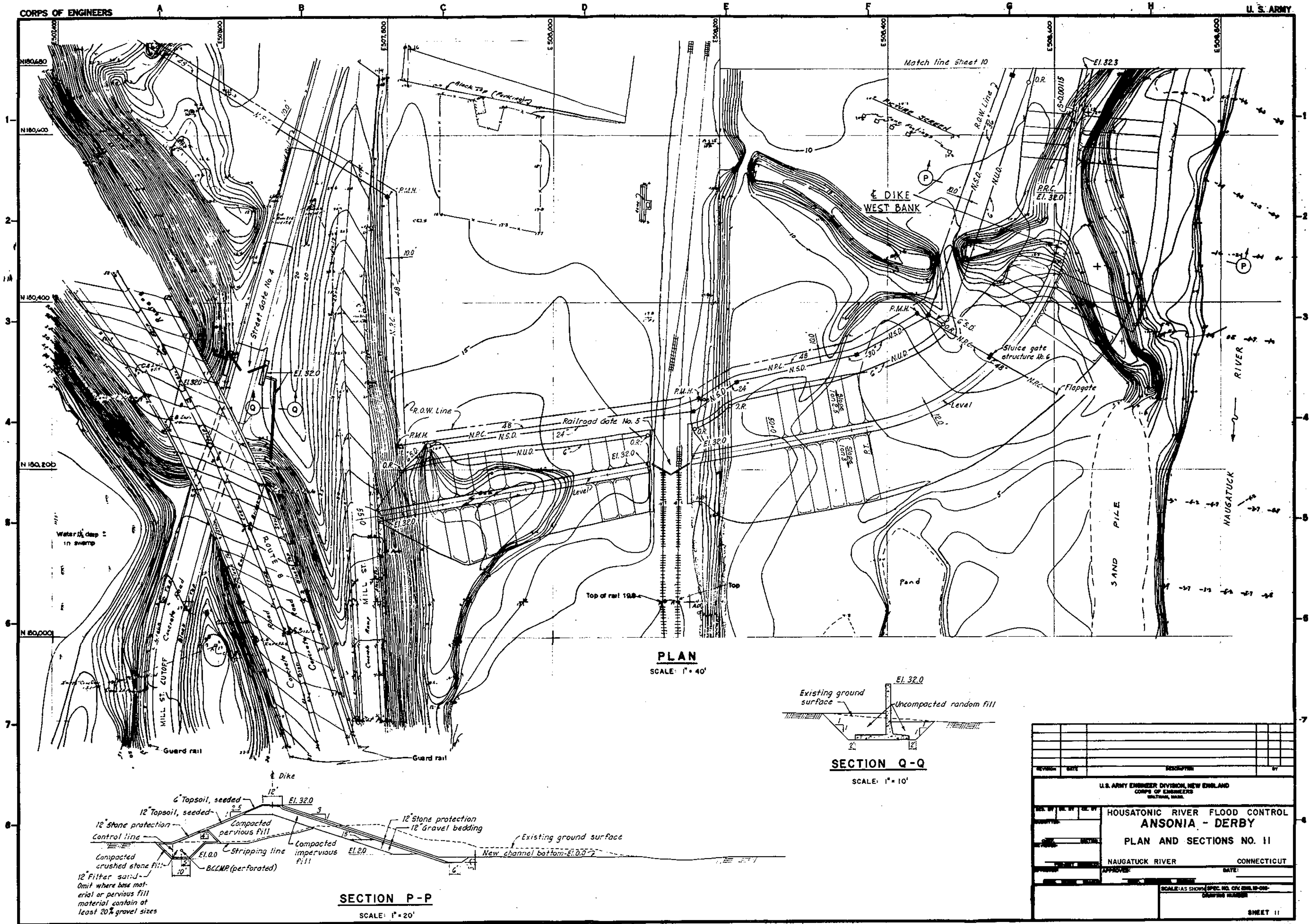
NAUGATUCK RIVER CONNECTICUT

SCALE: AS SHOWN | SPEC. NO. CIV. ENG. 19-016-

DRAWING NUMBER

SHEET 10.

PLATE NO. 3-11



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 11

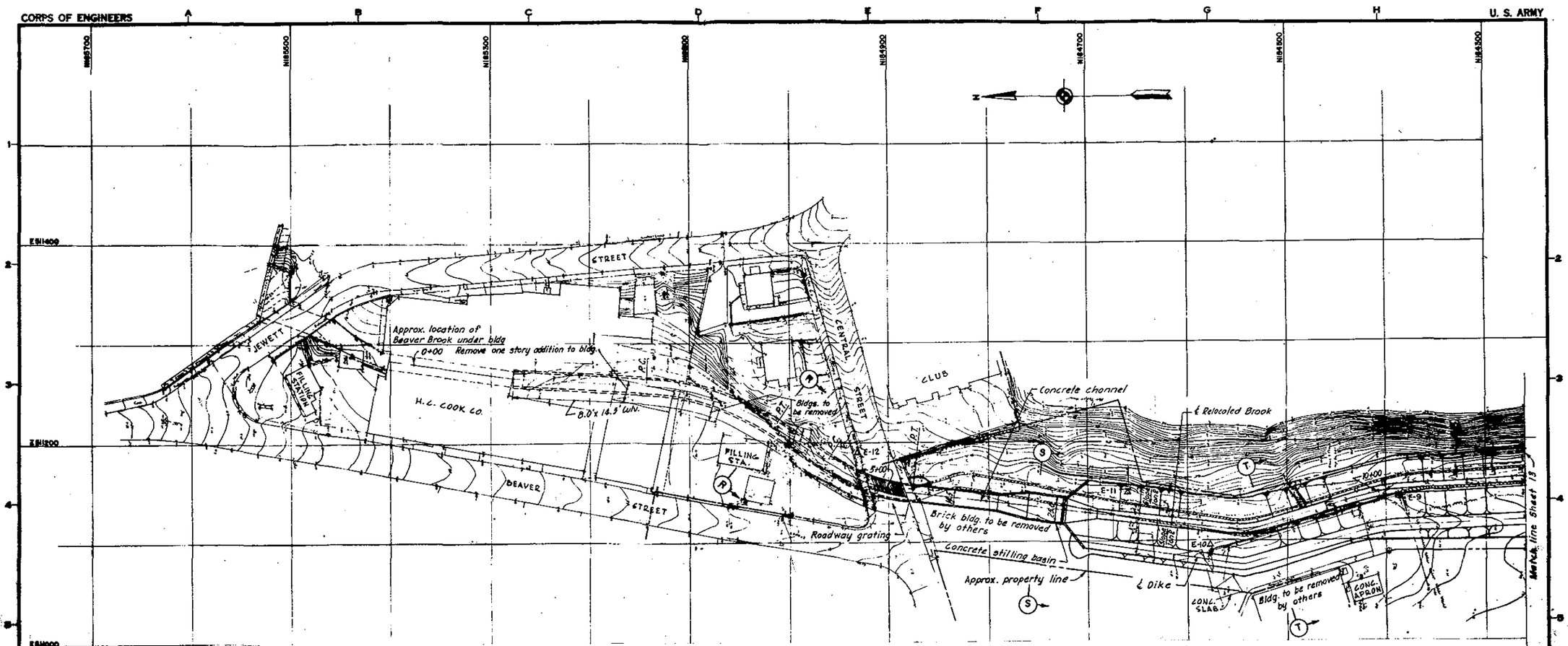
NAUGATUCK RIVER — CONNECTICUT

SCALE: AS SHOWN

SHEET 11

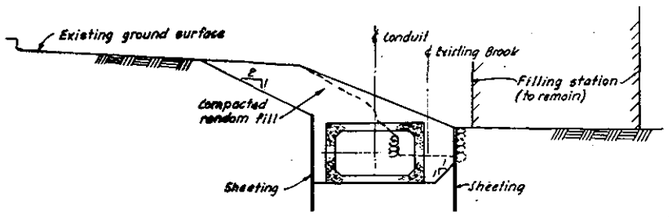
PLATE NO. 3-12

CORPS OF ENGINEERS — U. S. ARMY



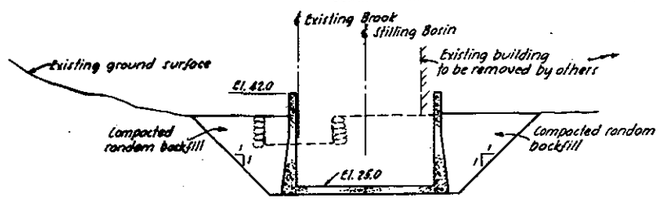
PLAN

SCALE 1" = 40'



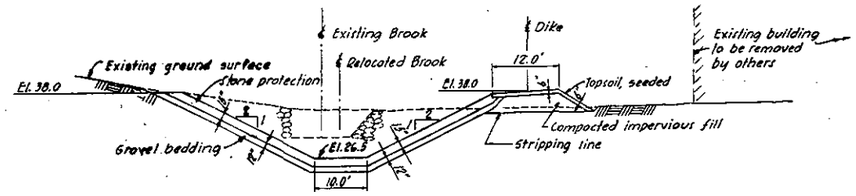
SECTION R-R

SCALE: 1" = 10'



SECTION S-S

SCALE: 1" = 10'



SECTION T-T

SCALE: 1" = 10'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

ENG. BY	DR. BY	CK. BY

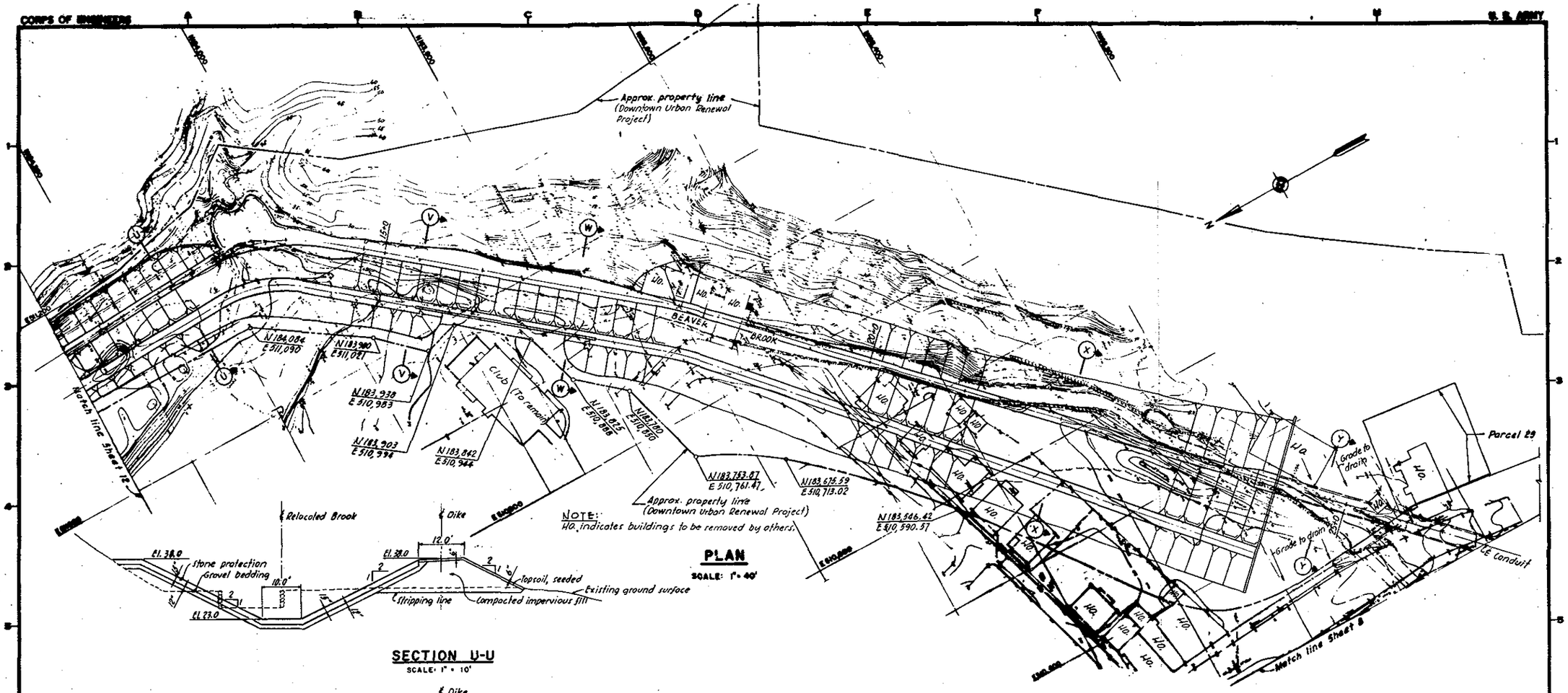
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 12
NAUGATUCK RIVER — CONNECTICUT

APPROVED: DATE:

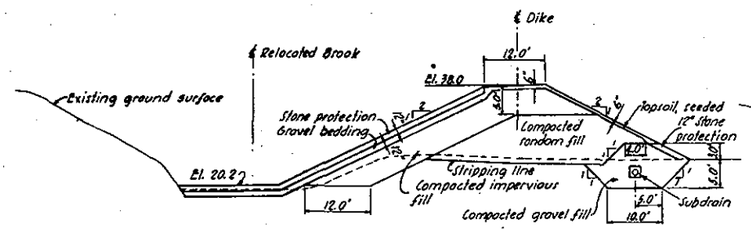
SCALE: NO SCALE — SPEC. NO. CIV. ENG. 19-ONE-
DRAWING NUMBER
SHEET 12

PLATE NO. 3-13

CORPS OF ENGINEERS — U. S. ARMY



SECTION U-U
SCALE: 1" = 10'



SECTION V-V
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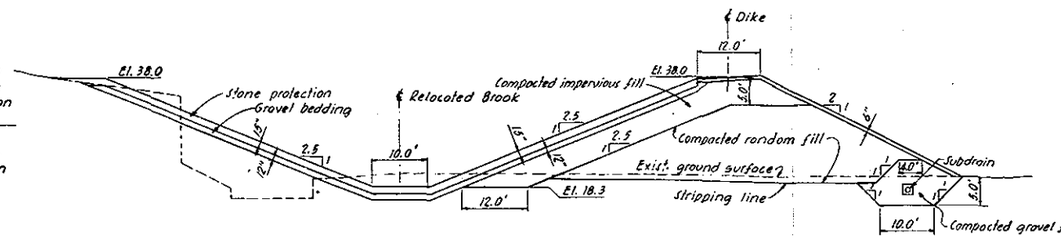

SECTION X-X
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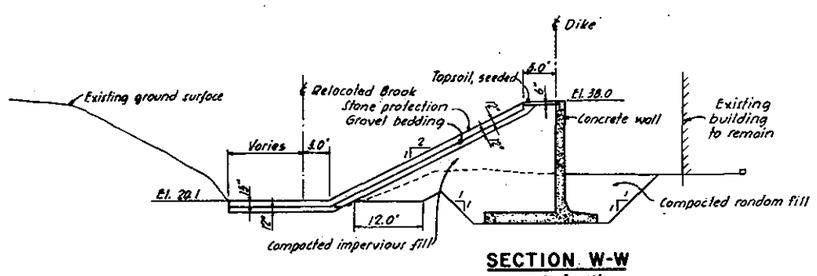

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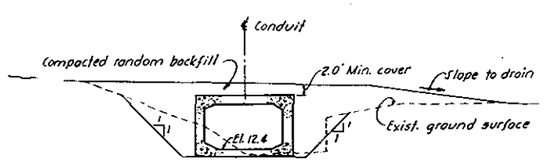
SCALE 1" = 10'



SECTION Y-Y
SCALE: 1" = 10'

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
PLAN AND SECTIONS NO. 13
NAUGATUCK RIVER — CONNECTICUT
APPROVED: DATE:
SCALE: AS SHOWN — DRAWING NUMBER
SHEET 13

PLATE NO. 3-14

CORPS OF ENGINEERS

U. S. ARMY

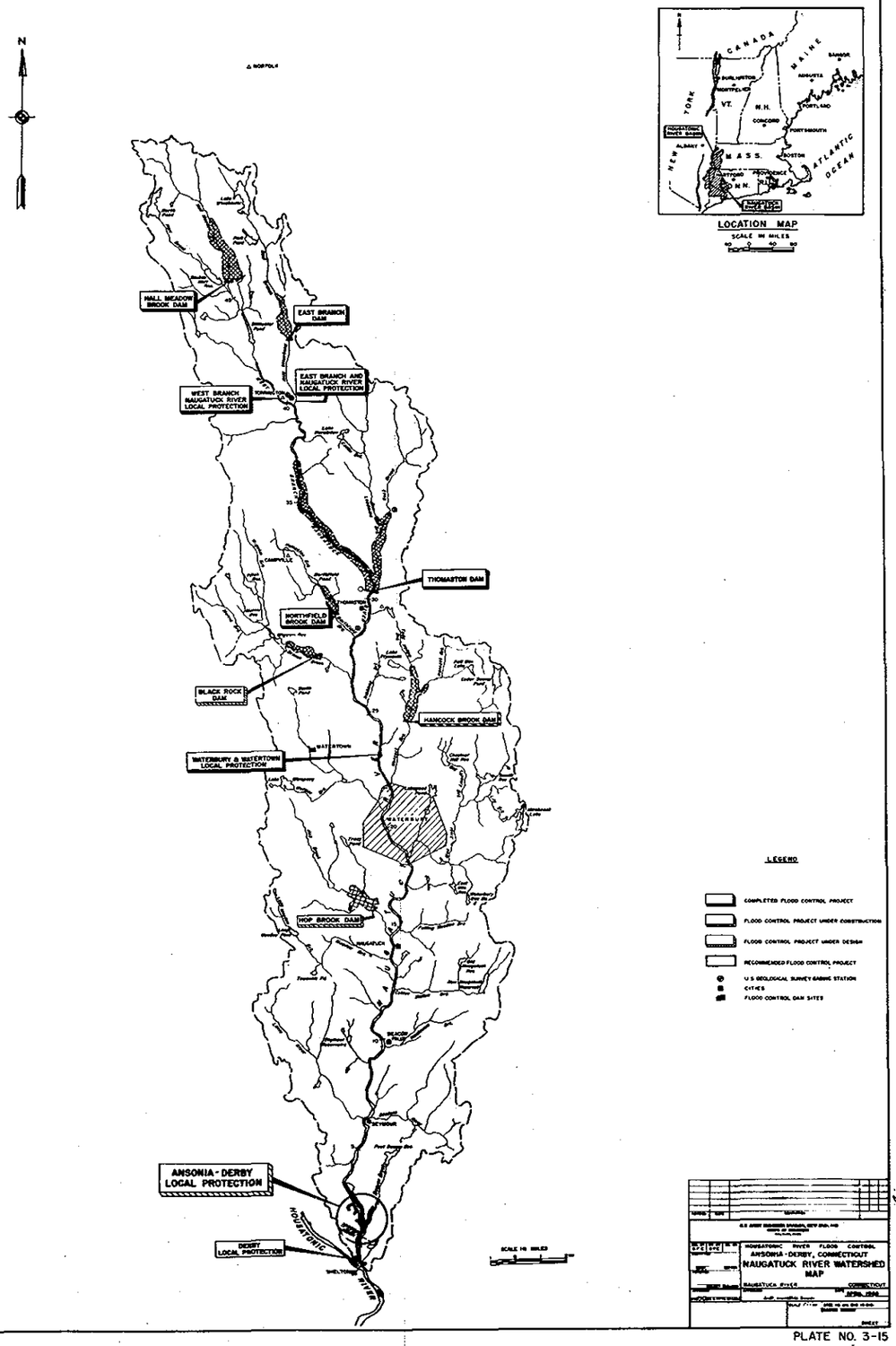
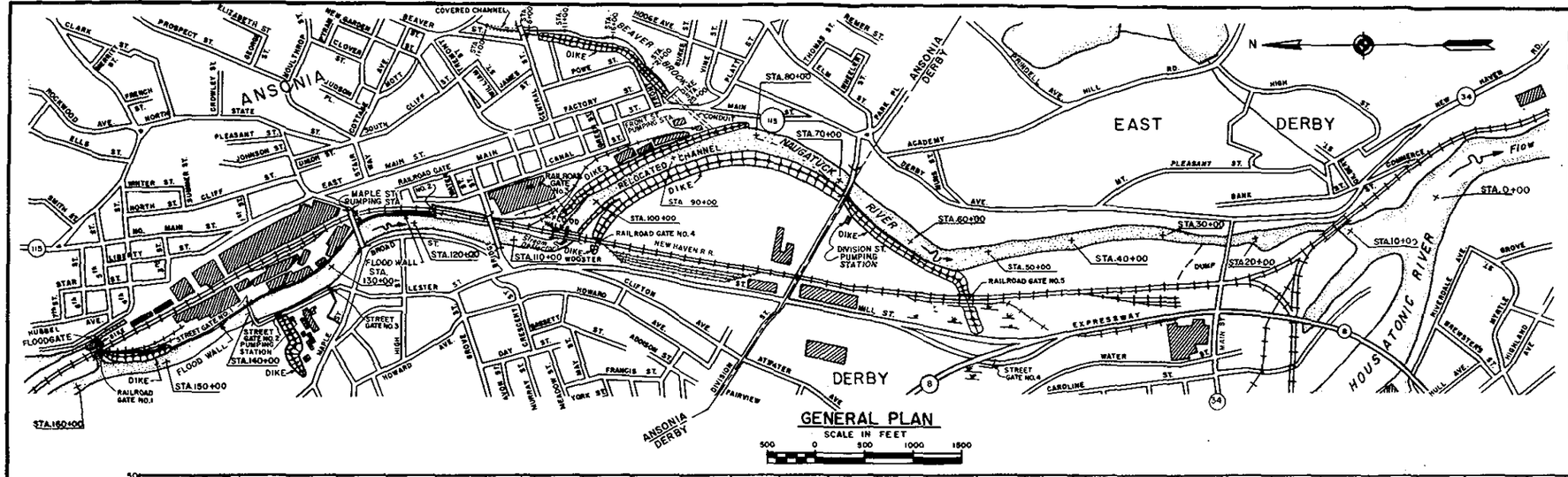


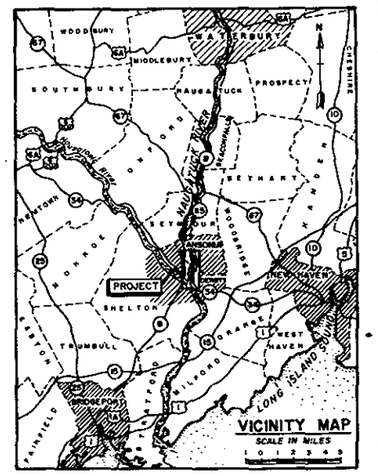
PLATE NO. 3-15

CORPS OF ENGINEERS

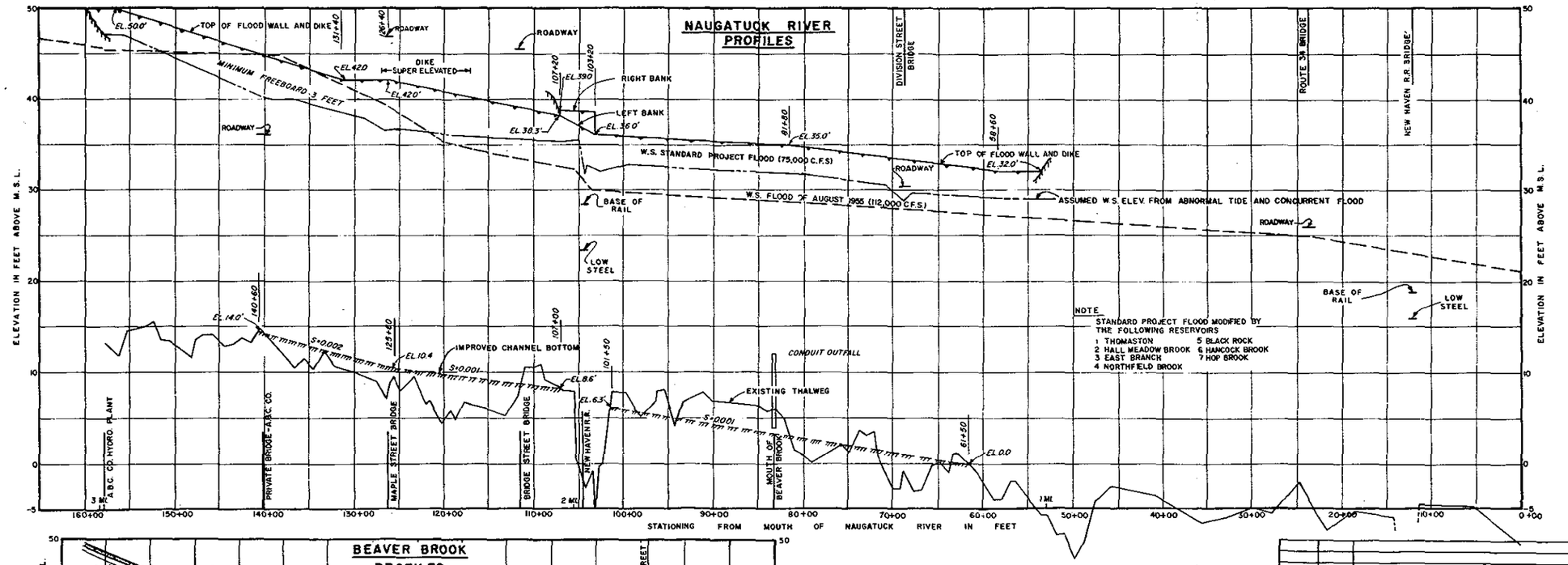
U. S. ARMY

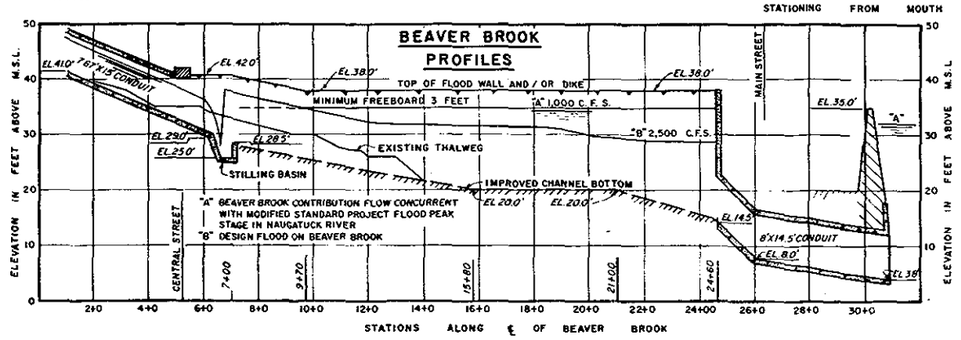


GENERAL PLAN
SCALE IN FEET
500 0 500 1000 1500



VICINITY MAP
SCALE IN MILES
1 0 1 2 3 4 5





LEGEND

- TOP OF DIKE AND / OR FLOOD WALL
- MODIFIED STANDARD PROJECT FLOOD PROFILE
- FLOOD OF AUGUST 1955 PROFILE
- IMPROVED CHANNEL BOTTOM
- EXISTING THALWEG

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY	TR. BY	CK. BY

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY CONNECTICUT
LOCAL PROTECTION
PLAN & PROFILES
NAUGATUCK RIVER, CONN.

APPROVED: DATE:
CHIEF ENGINEERING DIVISION

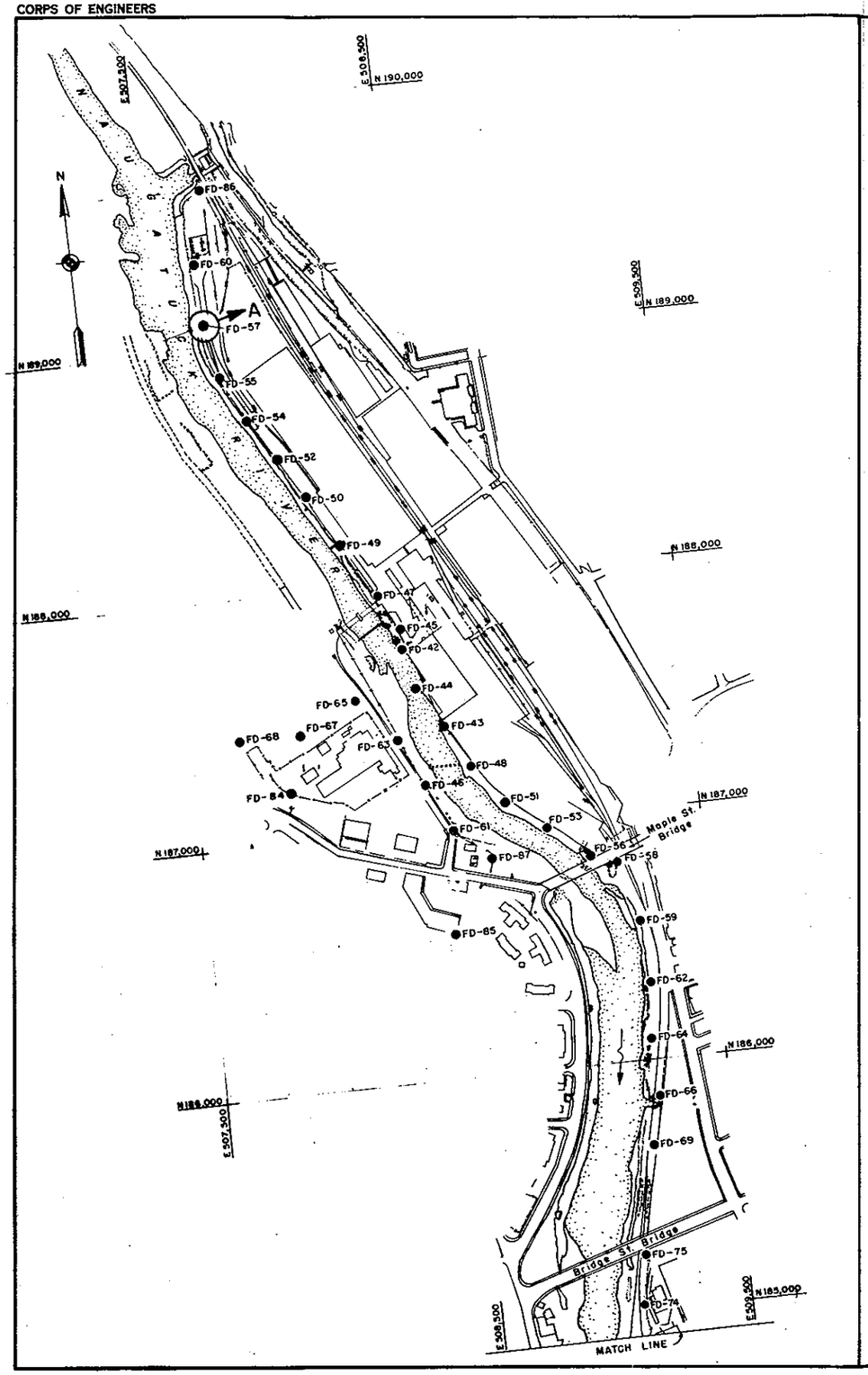
SCALE AS SHOWN

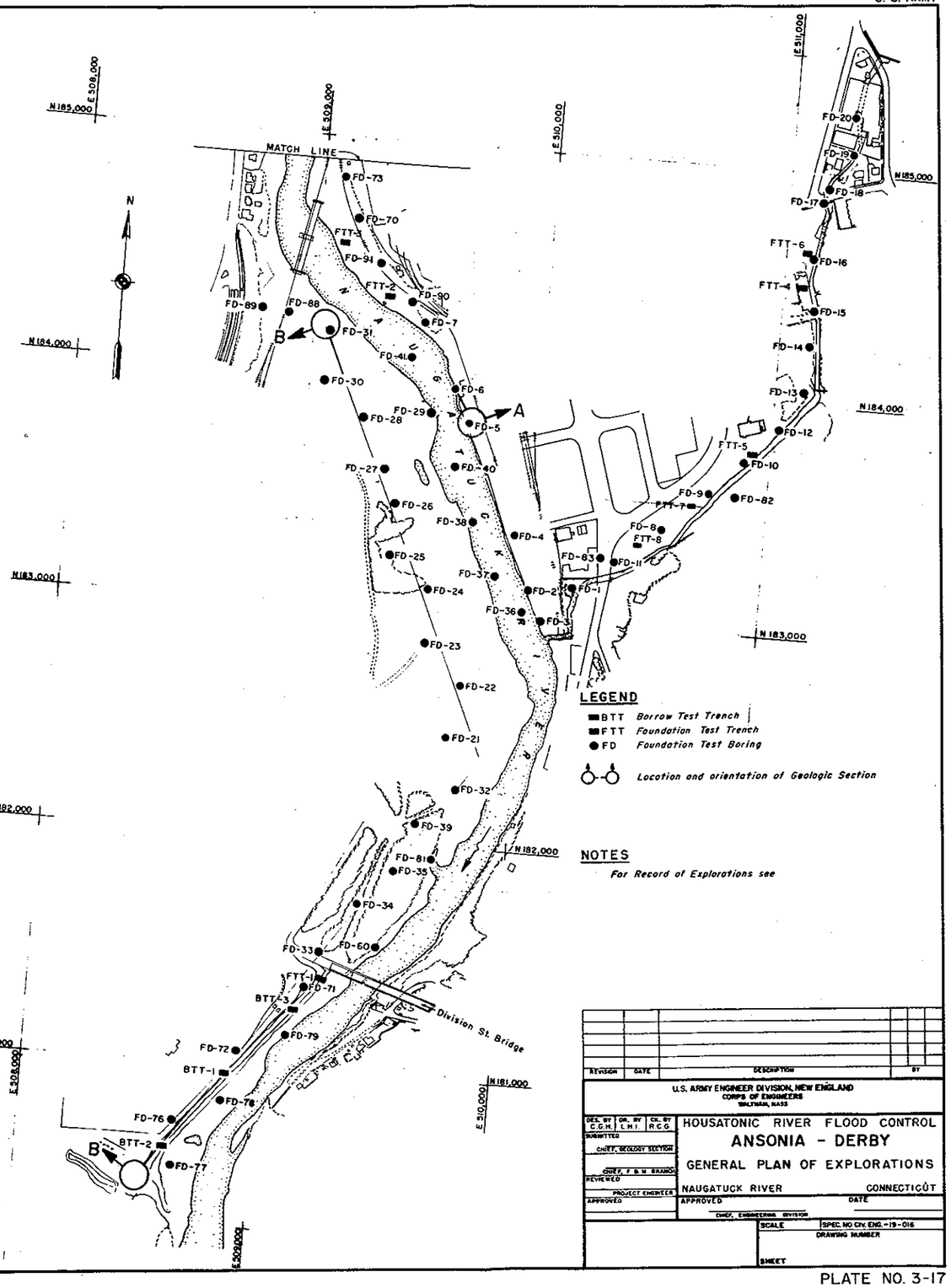
DRAWING NUMBER

PLATE NO. 3-16

CORPS OF ENGINEERS

U. S. ARMY





LEGEND

- BTT *Borrow Test Trench*
- FTT *Foundation Test Trench*
- FD *Foundation Test Boring*
- A-A *Location and orientation of Geologic Section*

NOTES

For Record of Explorations see

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY C.G.H.	DR. BY E.H.I	CK. BY R.C.G.

SUBMITTED
CHIEF, GEOLOGY SECTION
CHIEF, F & H BRANCH
REVIEWED
PROJECT ENGINEER
APPROVED
CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
GENERAL PLAN OF EXPLORATIONS
NAUGATUCK RIVER CONNECTICUT

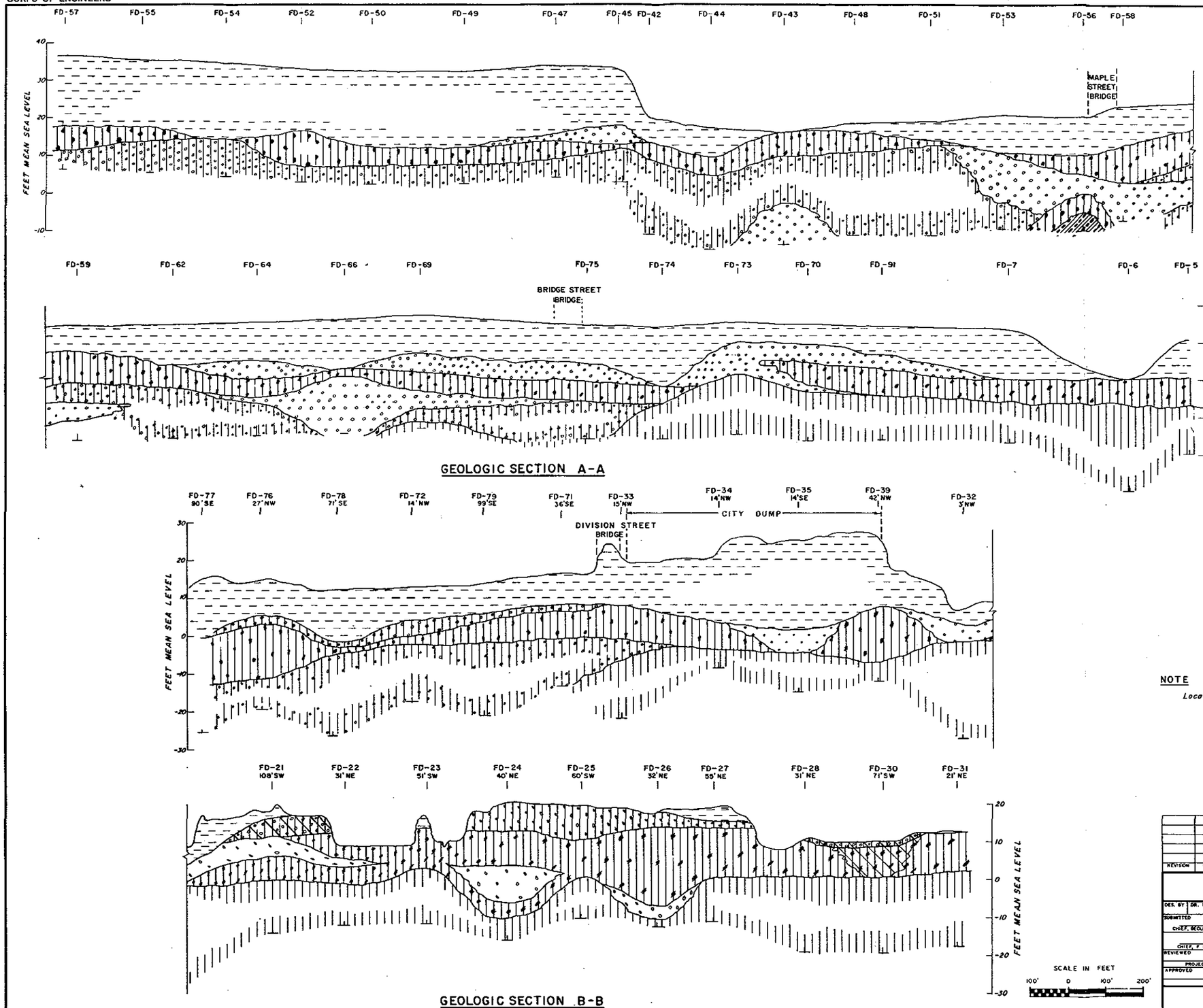
APPROVED DATE

SCALE
SPEC. NO CIV. ENG. - 19 - 016
DRAWING NUMBER
SHEET

PLATE NO. 3-17

CORPS OF ENGINEERS

U. S. ARMY



LEGEND

- FILL
- SAND
- Fine or med.-fine SAND, largely silty Partly with gravel, partly with cobbles
- Gravelly SAND, largely silty, with cobbles
- Sandy GRAVEL, largely silty, with cobbles
- Inorganic SILT, fine sandy SILT, or silty, fine SAND
- Glacial TILL
- *Contains organic material where shaded thus.*
- ⊥ *Elevation where boring stopped*

NOTE

Locations of sections are on PLATE

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY | DR. BY | CK. BY

SUBMITTED
CHIEF, GEOLOGY SECTION
CHIEF, F & H BRANCH
REVIEWED
PROJECT ENGINEER
APPROVED
CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
GEOLOGIC SECTIONS
NAUGATUCK RIVER CONNECTICUT

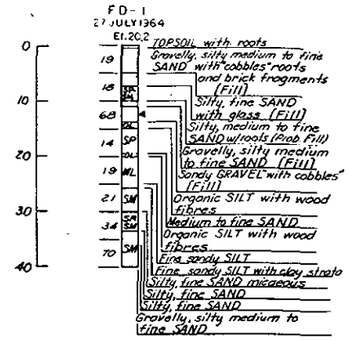
APPROVED DATE

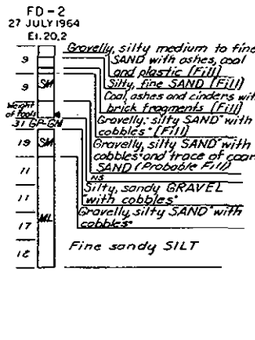
SCALE
SPEC. NO CIV. ENG. -19-016
DRAWING NUMBER
PLATE

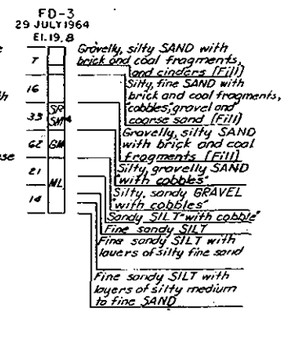
PLATE NO. 3-18

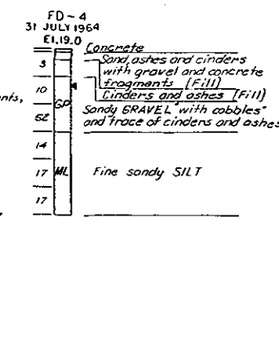
CORPS OF ENGINEERS

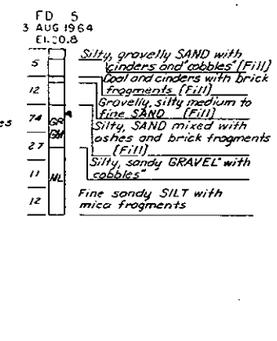
U. S. ARMY

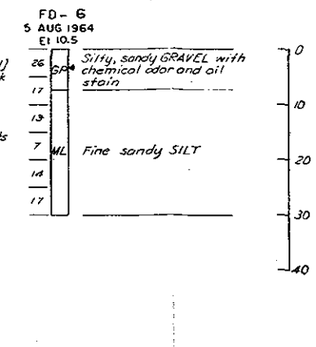


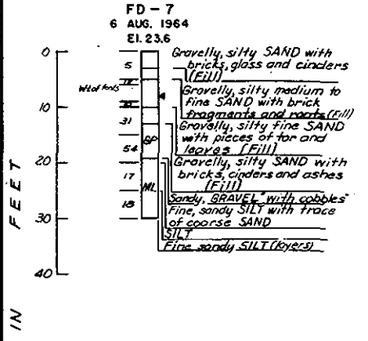


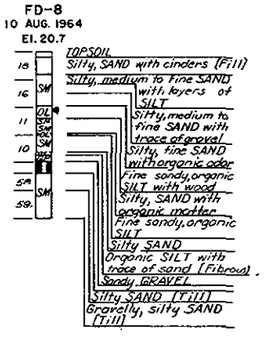


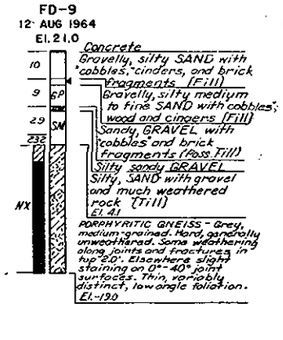


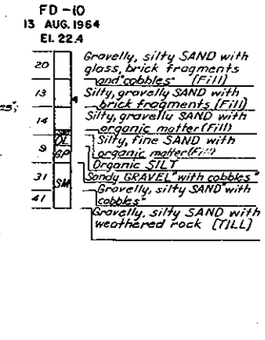


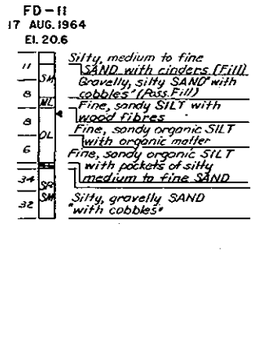


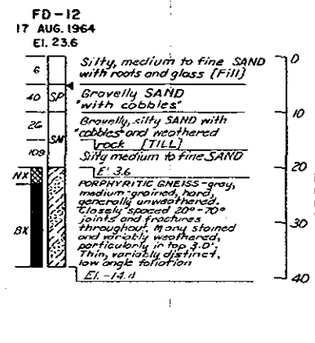


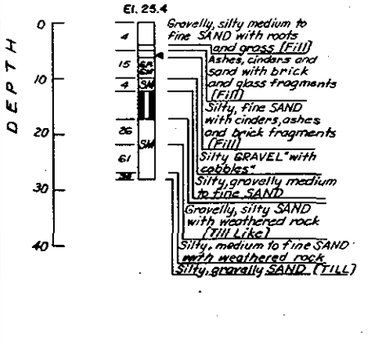


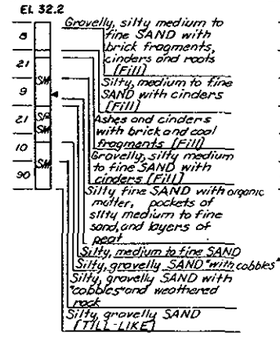


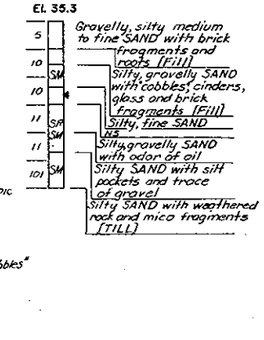


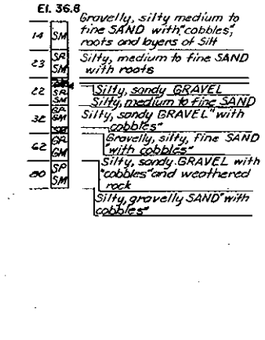


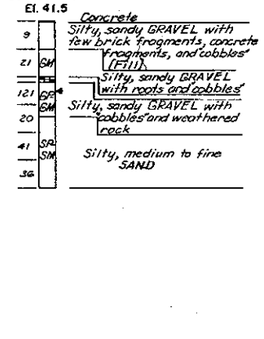


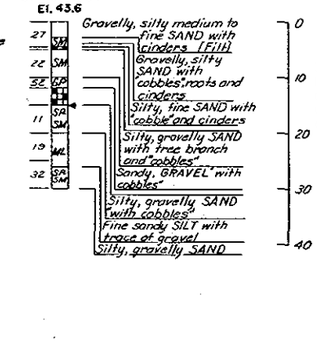


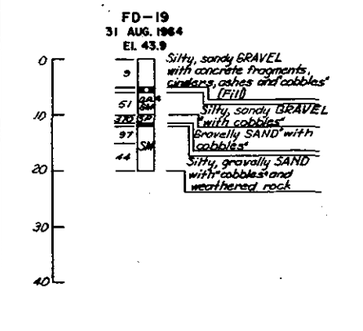


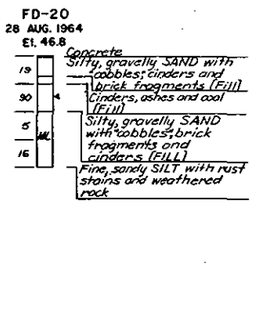


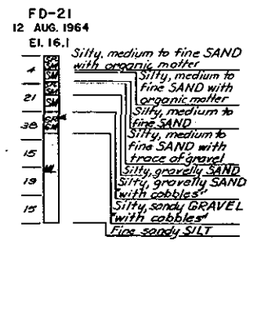


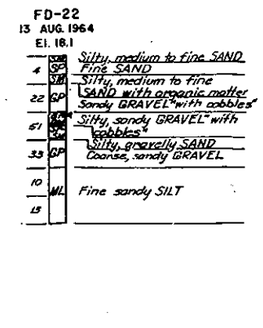


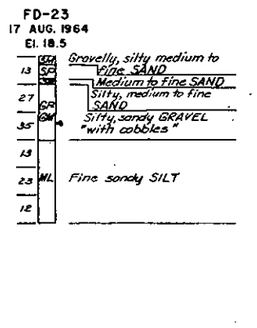


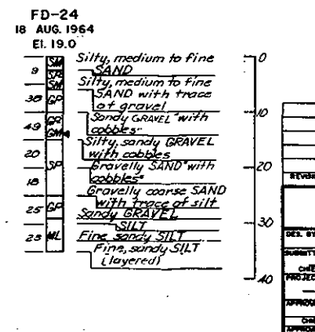












DEPTH IN FEET

LEGEND FOR GRAPHIC LOGS

FD — Foundation test boring
12 AUG 1965 — Date exploration completed
El. 20.8 — Elevation of ground surface during time of exploration
Subsurface water level in boring at time of exploration
Group letter symbol according to Unified Soil Classification System
Blows per foot of penetration considered most representative for each sample drive using a 300 or 350 pound hammer with a free fall of about 18" on a standard 5 foot, solid sample spoon with a beveled and sharpened drive shoe
Cobble or boulder (Core-drilled)
Cobbles or boulders, continuous or nested (core-drilled and/or blasted and chopped)
El. 4.1 Elevation of bedrock surface
Rock Symbol

Core Recovery
0 - 25 %
25 - 50 %
50 - 75 %
75 - 90 %
90 - 100 %

Letters left of column refer to standard core sizes
El. -12.0 Elevation bottom of exploration

NOTE
Subsurface water levels in some explorations may be subject to tidal fluctuations.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY	DR. BY	CK. BY

SUBMITTED
CHIEF, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, FOUNDATIONS BRANCH
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH

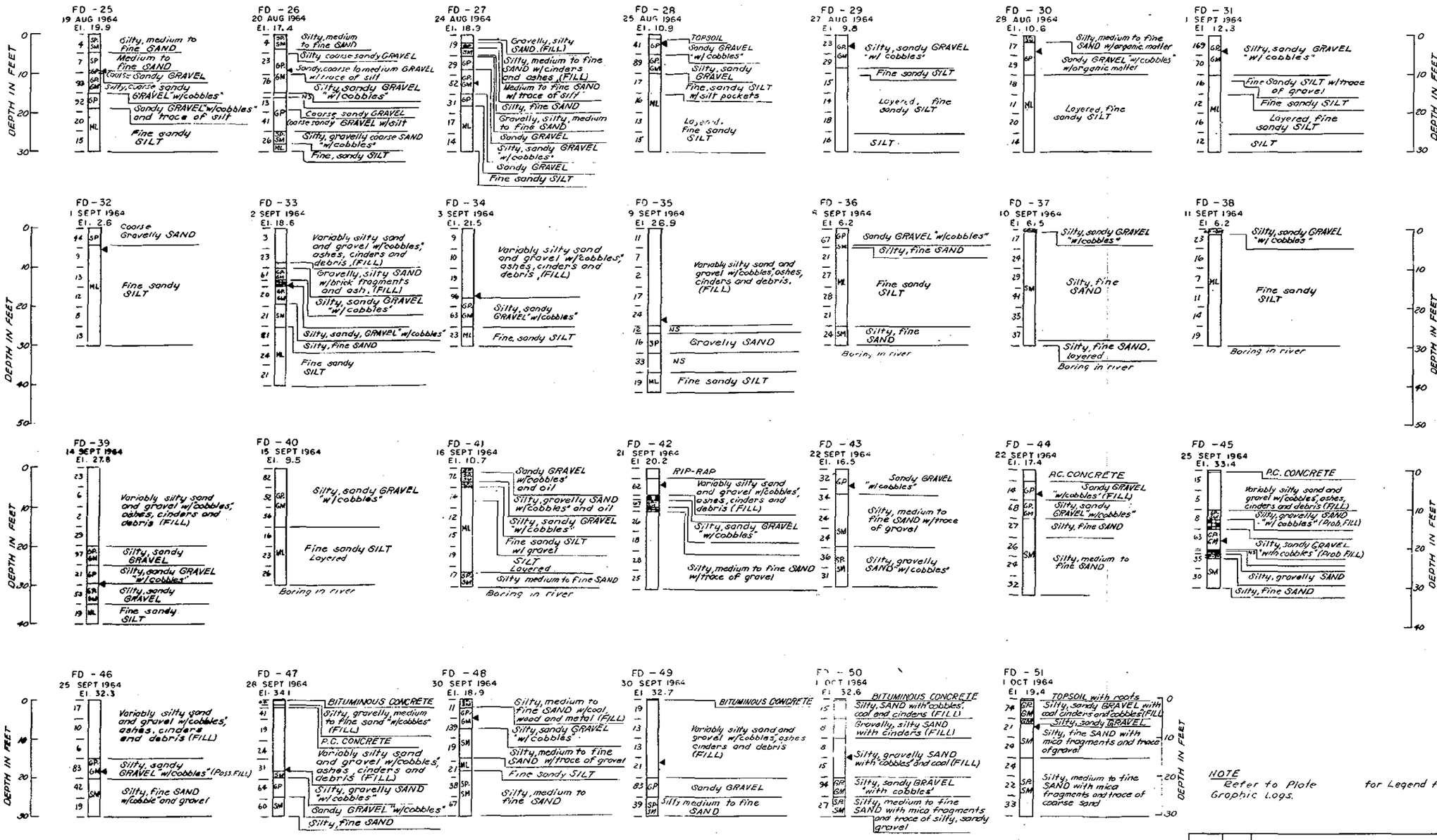
HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
RECORD OF FOUNDATION EXPLORATIONS
NO. 1
NAUGATUCK RIVER — CONNECTICUT
APPROVED — DATE
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO CIV. ENG. - 19 - 046
DRAWING NUMBER
SHEET

PLATE NO. 3-19

CORPS OF ENGINEERS

U. S. ARMY



NOTE
Refer to Plate for Legend for Graphic Logs.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY	DR. BY CMF	CK. BY
SUBMITTED		
CHIEF, GEOLOGY SECTION		
PROJECT ENGINEER		
APPROVAL RECOMMENDED		
CHIEF, FOR & WATER BRANCH		
APPROVAL RECOMMENDED		
CHIEF, DESIGN BRANCH		

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
RECORD OF FOUNDATION EXPLORATIONS
NO.2
NAUGATUCK RIVER CONNECTICUT

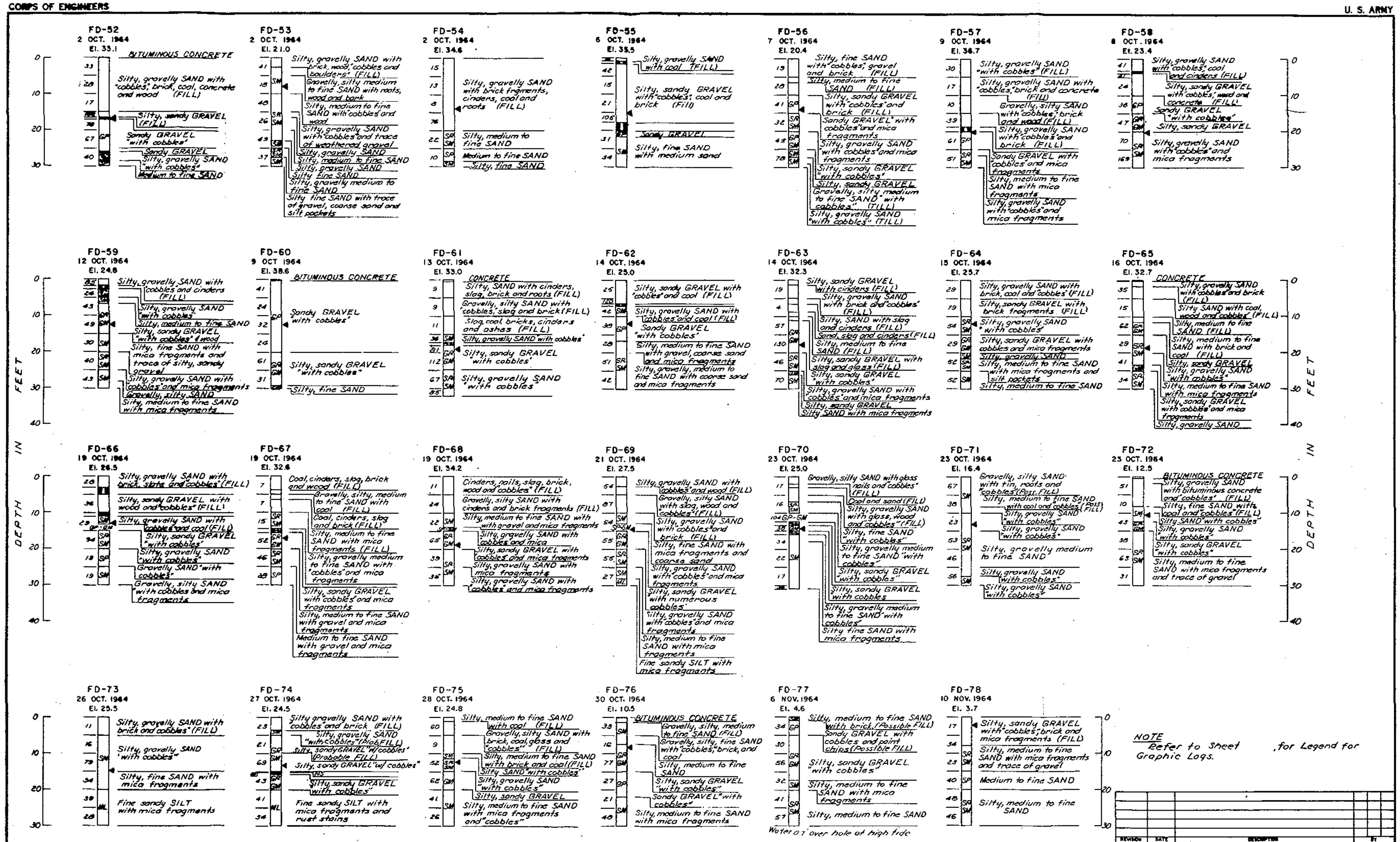
APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC. NO CIV. ENG. - 19 - 016
DRAWING NUMBER
SHEET

PLATE NO. 3-20

CORPS OF ENGINEERS

U. S. ARMY



NOTE
Refer to Sheet , for Legend for Graphic Logs.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
RECORD OF FOUNDATION EXPLORATIONS
NO. 3
NAUGATUCK RIVER CONNECTICUT

DES. BY | DR. BY | CK. BY
SUBMITTED
CHIEF, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, FDN & MAT'LS BRANCH
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVED
DATE
CHIEF, ENGINEERING DIVISION
SCALE
SPEC. NO. CIV. ENG.-19-016
DRAWING NUMBER
SHEET

PLATE NO. 3-21

CORPS OF ENGINEERS

U. S. ARMY

DEPTH IN FEET

FD-79
13 NOV. 1964
El. 2.6

0–23	GP	Sandy GRAVEL with "cobbles" and mica fragments
23–46	SP-SM	Silty, medium to fine SAND with mica fragments
46–51	ML	Fine, sandy SILT with trace of weathered gravel
51–63	SM	Silty, sandy GRAVEL "with weathered cobbles" (TILL)
63–193		Silty, gravelly SAND "with cobbles and weathered cobbles" (TILL)
		Silty, gravelly SAND (TILL)
		Silty, sandy GRAVEL with cobbles and weathered rock (TILL)

FD-80
17 NOV. 1964
El. 6.9

0–44	GP	Gravelly, coarse to medium SAND "with cobbles"
44–49	GP	Sandy GRAVEL "with cobbles"
49–51	ML	Fine, sandy SILT with mica fragments
51–119	SM	Silty, fine SAND with mica fragments, silt pockets and occasional cobbles"
		Silty, fine SAND with mica fragments and silt pockets
		Silty, gravelly SAND with mica fragments and "cobbles"

FD-81
17 NOV. 1964
El. 7.4

0–36	TOPSOIL	TOPSOIL with cobbles and roots
36–91	GP	Sandy GRAVEL "with cobbles"
	LNS	
	GP	Sandy GRAVEL "with cobbles"
91–118	ML	Fine sandy SILT with mica fragments

FD-82
18 MAR. 1965
El. 31.4

0–3		Gravelly, silty medium to fine SAND with wood, brick fragments, glass, metal, and cinders (FILL)
3–18		Gravelly, silty medium to fine SAND with glass, brick fragments, gravel and "cobbles" (FILL)
18–42	SM	Silty, medium to fine SAND with organic matter
42–166		Silty, gravelly medium to fine SAND with "cobbles" and weathered rock
		Gravelly silty SAND with weathered rock (TILL)

FD-83
22 MAR. 1965
El. 20.47

0–55		Concrete
		Gravelly, silty SAND with "cobbles", "boulders", coal, cinders and brick (FILL)
55–69	SP-SM	Gravelly, silty medium to fine SAND with coal and cinders (FILL)
69–73		Silty, gravelly SAND with gravel, coarse sand and coal
	LNS	
73–116	SM	Silty, gravelly SAND with weathered gravel
		Gravelly, silty SAND with weathered gravel and mica fragments

FD-84
24 MAR. 1965
El. 32.79

0–22		Silty, gravelly SAND with cobbles, brick and metal (FILL)
22–34	SP-SM	Silty, gravelly SAND (FILL)
		Silty, fine SAND with organic
		Silty, gravelly SAND with mica fragments and "cobbles"
		Silty, gravelly SAND
		Silty, fine SAND with medium sand and mica fragments
		Silty, medium to fine SAND
		Silty, gravelly SAND with cobbles and mica fragments
		Silty, gravelly SAND

FD-85
25 MAR. 1965
El. 35.83

0–33		Silty, gravelly SAND with cobbles, coal, cinders and brick fragments (FILL)
33–47	FILL	
47–56	GP	Silty, fine SAND with roots and mica fragments
		Sandy GRAVEL with cobbles
56–79	SM	Silty, medium to fine SAND with mica fragments
		Silty, medium to fine SAND with coarse sand, gravel, cobbles and mica fragments

FD-86
20 APR. 1965
El. 38.69

0–17	SP-SM	Silty, gravelly SAND "with cobbles"
17–24	GM-GP	Silty, sandy GRAVEL (miscellaneous)
24–27	SM	Silty, gravelly SAND
27–52		Weathered Rock
52–58		Weathered Rock with micaceous sand
Wx	LNS	Weathered Rock with micaceous sand El. 13.09
		GNEISS - Porphyritic, greenish, light gray, Med.-grained w/some large phenocrysts. Chloritic, Foliation dip approximately 70°. Broken, weathered zone at 27.9'. Otherwise unweathered to slightly weathered. Hard. El. 6.09
		100% Water loss at 27.1'.
		Hole caved at 27.1' reduced to BX

FD-87
21 APR. 1965
El. 34.35

0–10	SP-SM	Gravelly, silty SAND (FILL)
10–47	SM	Silty, gravelly SAND "with cobble"
47–59		Gravelly, silty SAND
59–73	SP-SM	Silty, gravelly SAND

FD-88
23 APR. 1965
El. 26.33

0–4	SP	Gravelly SAND
4–34		
34–67	GP-GM	Silty, sandy GRAVEL
67–78		
78–87	SM	Gravelly, silty medium to fine SAND
87–96	ML	Fine, sandy SILT, with layers of fine sand and silt

FD-89
27 APR. 1965
El. 24.56

0–52	SP-SM	Silty, gravelly SAND "with cobbles" (FILL)
52–63	SM	Gravelly, silty medium to fine SAND
63–68		Silty, fine SAND
68–70	SP	Gravelly SAND
70–85	SM	Silty, gravelly medium to fine SAND
85–100	ML	Sandy, silty GRAVEL
		Fine sandy SILT

FD-90
29 APR. 1965
El. 23.36

0–7		
7–10		Silty, SAND with cinders, brick, wood and concrete (FILL)
10–98		
98–109	ML	Fine sandy SILT with mica fragments
109–123		

FD-91
3 MAY 1965
El. 23.90

0–8	SM	Silty, gravelly SAND
8–12		Sandy GRAVEL
12–125	GP	Sandy GRAVEL "with cobbles"
125–143		
143–163	ML	Fine sandy SILT with mica fragments
163–177		

FTT-1
30 SEPT 1958
El.

0–10		Loose, medium to fine SAND (FILL)
		Coarse SAND and fine SAND (laminated) (FILL)
10–20		Sandy gravel with stones, cobbles, glass and bricks (FILL)

Trench Dimensions

Cobbles and Boulders

4" - 6"	0
6" - 12"	0
Over 12"	0

NOTE

FTT-1 was a sewer construction excavation and was not sampled

FTT-2
13 JAN. 1965
El. 20.0

0–10		Loose, silty gravelly SAND with pockets of loose, silty medium to fine SAND and also brick, wood, and scrap metal (FILL)
10–20		Loose, silty sandy gravel with cobbles, brick, wood and glass (FILL)
		Loose, sandy gravel with brick and glass (FILL)

Trench Dimensions 15.1'x 4.6'x 12.5'

Cobbles and Boulders

4" - 6"	10
6" - 12"	6
Over 12"	0

FTT-3
14 JAN. 1965
El. 22.0

0–10		Loose silty sandy GRAVEL with pockets of gravelly silty sand, and also cobbles brick, wood, scrap metal and glass (FILL)
10–20	SM	Loose, silty fine SAND

Trench Dimensions 17.4'x 3.9'x 12.8'

Cobbles and Boulders

4" - 6"	150
6" - 12"	20
Over 12	0

FTT-4
18 JAN. 1965
El. 35.9

0–10		Loose, silty sandy GRAVEL with brick, asphalt and pockets of cinders (FILL)
10–20	SM	Loose, silty medium to fine SAND with traces of gravel and also brick, cinders and scrap metal (FILL)
		Loose silty medium to fine SAND with cinders (FILL)
		Loose, gravelly silty SAND with roots

Trench Dimensions 16.1'x 3.5'x 11.7'

Cobbles and Boulders

4" - 6"	80
6" - 12"	3
Over 12"	0

FTT-5
18 JAN. 1965
El. 23.1

0–10	SM	Loose, silty gravelly SAND
		Loose, silty fine SAND with brick and cinders (FILL)
		Loose silty sandy GRAVEL with scrap metal, glass, brick and debris from old river bed

Trench Dimensions 13.1'x 3.5'x 7.3'

Cobbles and Boulders

4" - 6"	80
6" - 12"	2
Over 12"	0

FTT-6
18 JAN. 1965
El. 36.2

0–10		Loose, silty sandy gravel with brick, glass and pockets of cinders (FILL)
10–20	GP-GM	Cinders with brick fragments, glass, scrap metal, and also pockets of silty gravelly medium to fine sand (FILL)
		Loose, silty sandy GRAVEL

Trench Dimensions 11.9'x 3.5'x 8.1'

Cobbles and Boulders

4" - 6"	45
6" - 12"	3
Over 12"	0

FTT-7
19 JAN 1965
El. 20.2

0–10		Medium compact gravelly silty medium to fine SAND with organic matter, wood, glass and pockets of cinders (FILL)
10–20	SM-ML	Loose gravelly silty medium to fine SAND with wood, glass and cinders (FILL)
		Loose silty fine SAND
		Loose fine sandy SILT with organic matter

Trench Dimensions 12.2'x 3.4'x 11.1'

Cobbles and Boulders

4" - 6"	40
6" - 12"	0
Over 12"	0

FTT-8
19 JAN. 1965
El. 21.3

0–10		Loose, silty sandy GRAVEL with cobbles, wood, brick, glass, and concrete (FILL)
10–20	ML	Loose, fine sandy SILT

Trench Dimensions 15.1'x 3.8'x 10.9

Cobbles and Boulders

4" - 6"	120
6" - 12"	20
Over 12"	10

NOTE

Refer to Plate No. for Legend for Graphic Logs.

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U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
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HOUSATONIC RIVER FLOOD CONTROL
ANSONIA - DERBY
RECORD OF FOUNDATION EXPLORATIONS
NO.4
NAUGATUCK RIVER CONNECTICUT
APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC. NO CIV. ENG. - 19 - 048
DRAWING NUMBER
SHEET

PLATE NO. 3-22